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The increasing use of paper in the manufacture of war weapons and supplies is now coupled with an extreme shortage of manpower to cut timber for paper mills. But voluntary cooperation on the part of the public in fighting waste can, in effect, guarantee adequate supplies of paper for war production and our home front economy.

We must salvage paper normally thrown in the waste basket. Waste paper directly replaces pulp in the production of new paper and paper board containers. We can further help to guarantee sufficient supplies of paper. The conservation of containers is largely a job for industry and industrial users rather than the public in general, although the active help of the people at large must now be enlisted.

Tremendous savings can be made in wrapping paper if merchants will avoid wrapping packages when possible. We must curtail unnecessary uses of paper so that every pound meets war and essential civilian needs. We must use all paper wisely. It is a war material much needed by our armed forces and those of our Allies.

Here are a few facts and figures which will help us understand why the paper shortage exists—every standard unit of small-arms ammunition has its containers . . . paperboard targets are used for pistol, rifle nd machine-gun practice . . . U. S. Army Field Ration "K" is packed in folding cartons . . . 100 pounds of waste paper will make 650 cartons for Ration "K" . . . paperboard protects every large shell until it is fired . . . 100 pounds of waste paper will make 115 boxes each containing ten 20-mm. shells . . . 100 pounds of waste paper will make fifty 75-mm. shell containers . . . a partial list of the essential military items made of paper include bomb bands, parachute flares, fuel tank linings, practice bombs, airplane signals and shell containers.

Is it any wonder that all of us—as members of the industrial family and as individuals—must conserve all paper as insurance against paper mill shut-downs and subsequent failure in the production and shipment of military necessities?

Economical Degreasing with Chlorinated Solvents

By T. J. KEARNEY

Technical Assistant to Vice President, Detrex Corporation

IN THE proper processing and finishing of metal products, including many ordnance items, the most important requirement is to get a chemically clean surface. This article covers the use of chlorinated solvents and points out their economical use in three basic types of degreasing machines now in general use. It includes a description of the various types of solvent degreasing machines and solvents recommended which, when given proper cognizance, result in economical cleaning.

Solvent degreasing involves the economical utilization of the physical and chemical properties of the chlorinated hydrocarbon solvents, employing these solvents, heated, as a liquid or a vapor, to produce efficient and rapid oil and grease removal.

Solvent degreasing, taking advantage of the low boiling point, low specific heat, and high vapor density of these solvents in a controlled process, produces the desired cleaning results on both ferrous and non-ferrous metals without attack. Many other non-absorbent materials lend themselves to cleaning by this process.

For economical operation, the proper solvent for the particular application must be chosen and the equipment manufacturer's recommendations on installation, operation and maintenace must be followed.

Solvent degreasing is a simple process as it depends merely upon the dissolving of oil and grease by a stabilized non-flammable chlorinated hydrocarbon solvent either in the heated liquid or the vapor state. For the most effective use of these solvents properly designed degreasing equipment is essential. The fundamental principles to be followed will be outlined by referring to the three basic types of degreasers in general use. They are known as: (1) vapor; (2) immersion; and, (3) spray types. Depending upon the kind of work to be cleaned, any combination of these three types may be incorporated in one unit.

Vapor Degreasing

The simple vapor degreaser of the type shown in Fig. 1 consists essen-

tially of a chamber in which the liquid solvent is boiled, a space above this boiling chamber containing hot solvent vapors (in which the work is cleaned), and a condenser to maintain the proper vapor level in the apparatus and a proper height sideboard or freeboard above the water jacket or condensing area properly proportioned to the dimensions of the machine.

The condenser around the upper portion of the vapor chamber, in most cases a water jacket or a water jacket and condenser coils, condenses the solvent vapors which are returned to the desired chamber. The heat absorbent capacity of the condenser is balanced against the heat input and, inasmuch as the solvent vapor is approximately four and one-half times as heavy as air, it is readily retained in the apparatus.

In the vapor method of degreasing, the work to be cleaned is lowered (by hand or conveyor) into the vapor only. While in this position, the work being c o l d e r than the vapor, the chemically pure solvent vapors are condensed upon it. The cleaning power of the vapor action depends entirely upon the difference in temperature between the metal and the solvent vapor (vapor temperature approximately 188 degrees F.). The condensate continuously washes the metal surfaces as long as the work remains in the vapor, but the washing effect diminishes as the temperature of the metal approaches that of the vapor.

Important advantages of the vapor method of cleaning are: its extreme simplicity; less expensive apparatus, and the fact that only pure solvent vapors will reach the work no matter how contaminated the boiling solvent becomes. This is due to the difference in the boiling point between the dissolved oil or grease and the solvent. After the parts have been vapor degreased the work is removed from the machine, free from oil and grease, warm and dry. The complete cleaning cycle requires, in general, less than one minute.

The limitations of the vapor method are: in the cleaning of large pieces of light gauge metal by the vapor method, the lower portion of the work is heated first by the vapor and this heat has a tendency to be conducted up through the metal before the vapor has an opportunity to condense uniformly on the upper portion of the work. In addition, cupped or intricate shaped parts and beaded work have a tendency to trap the oil and solvent, as well as to contain air pockets which exclude the solvent vapors.

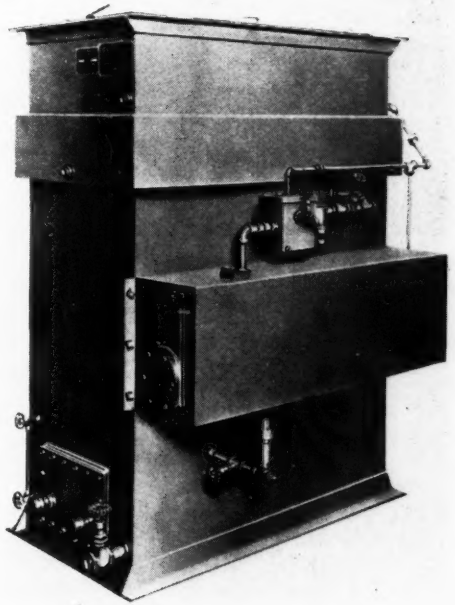

Fig. 1—A simple hand-operated, vapor-type degreaser arranged for steam heating is shown here.

There is practically no mechanical action in vapor degreasing and, accordingly, it is not effective in the removal of insoluble matter.

Vapor-Slush Degreasing

When the work being cleaned is large gauge sheet metal or formed parts which have pockets or tapped holes, the vapor-slush method is a highly desirable hand or hoist-operated method of cleaning. In this design clean solvent distillate is sprayed over the work to augment the cleaning results obtainable by straight vapor degreasing. A vapor-slush-vapor degreaser can be seen in Fig. 2.

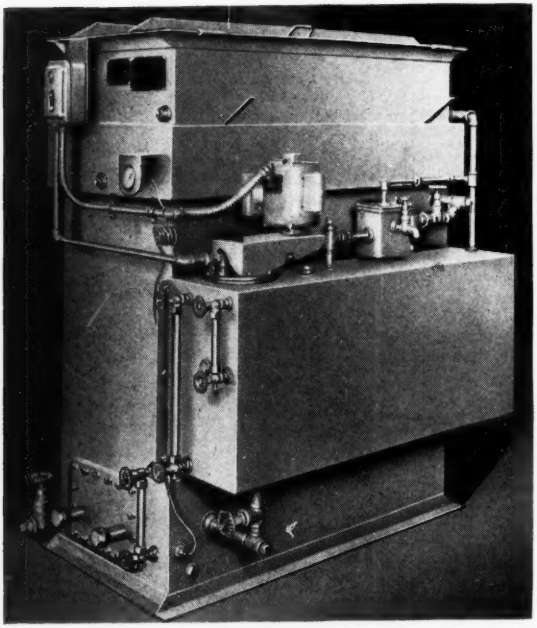

Fig. 2—A vapor-slush-vapor degreaser—the cycle of cleaning phases is vapor, hand spray of solvent distillate, and finally pure vapor cleaning.

The solvent sprayed is distillate which has been condensed from the solvent vapors within the degreaser and accumulated for intermediate spraying operation. The vapor-slush method is recommended when a small amount of spray per work load is required. Economy and safety factors limit the quantity of distillate that can be made available for the slushing operation.

Immersion Degreasing

Parts which are nested or are of intricate shape are often more adapted to the immersion degreasing process. Here the work is lowered into the boiling solvent, and a positive degreasing action is obtained by the continuous sweep of boiling solvent over the work which gives a washing or scrubbing effect that assists in the removal of solid particles insoluble in the solvent. Immersion degreasers are designed with one, two or three chambers. The usual sequence of cleaning operations in these machines is: first, immersion in the boiling solvent to remove heavy grease and dirt; then, into a chamber containing clean solvent to rinse and cool the metal, and then a final pure vapor rinse. Additional heat required to dry the work rapidly is obtained in this final vapor rinse.

Although the solvent in the heating chamber does become contaminated in the course of time, in two and three-chamber designs the rinse is constantly being diluted by a continuous supply of clean condensate through it. This cycle insures high quality cleaning and is effective on light gauge as well as heavy gauge parts or parts of intricate design, inamuch as all work receives a final pure vapor rinse. Immersion degreasers are fabri-

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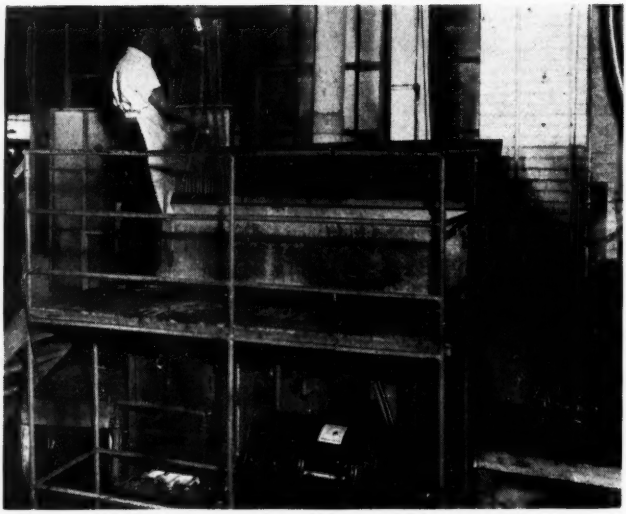

Fig. 3—This immersion-type gas-heated degreaser is in use at the Detroit Harvester Company for the cleaning of miscellaneous machined metal parts. An electric hoist facilitates the operation and insures the correct speed.

cated both for hand and crossrod conveyor operation.

Figure 3 presents a view of an immersion-type gas-heated degreaser installed and in operation at the Detroit Harvester Company for the cleaning of miscellaneous machined metal parts. A conveniently located operator's platform adjoins the machine. Correct speed of operation is assured by the use of an electric hoist which has a maximum speed of 11 feet per minute.

Vapor-Spray-Vapor Degreasing

Vapor-spray-vapor degreasing is claimed to be the most positive method of removing caked-on or insoluble material. In this method of cleaning the work is first wet with solvent vapors, then hot solvent is sprayed over the work, mechanically removing and driving off the solid particles, reaching depressions and open cavities. The spraying operation is followed by a final vapor rinse to insure complete removal of oil or grease, and at the same time impart sufficient heat to the work to allow it to dry before it is brought out of the degreasing unit.

Many parts, due to their size, shape and construction, are not adapted to immersion cleaning. It is also very difficult to adapt immersion cleaning to monorail conveyorized equipment. Therefore, a spray method of cleaning is employed for these applications.

There are many types of automatic and semi-automatic conveyors which can be incorporated in the design of vapor - spray - vapor degreasers. The choice of such equipment depends upon the size and shape of the work and the adaptation of the conveyor method to the production problem.

A cutaway view of a through-type, vapor-spray-vapor degreaser equipped with monorail conveyor is shown in Fig. 4. The monorail conveyor ties in with the customer's conveyor system to provide a fully automatic cleaning cycle in the production line.

Solvent Stills

Degreasers are self-distilling for the reclamation of the solvent after contamination; that is, the degreaser itself can be used to distill and condense the solvent into a satisfactory container. With some types of work, especially in the case of installations where it is not desirable to interrupt production or where the contamination removed is heavy, the use of a

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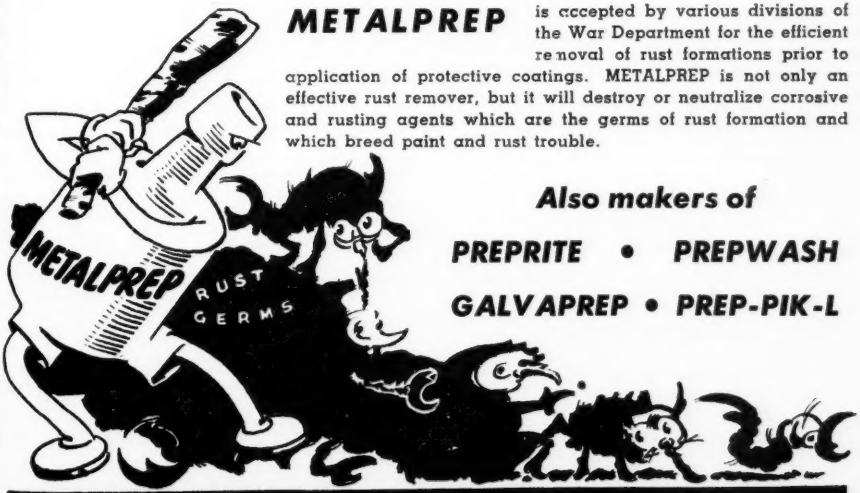
5. Rusted shells cannot be filled with explosives.
6. Ships have to be dry-docked periodically to remove rust and scale.
7. RUST, WHEREVER IT OCCURS, CAUSES PAINT FAILURE AND TROUBLE.



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separate solvent still is recommended. Solvent stills are so designed that they may be run continuously or intermittently (batch operation).

The modern-day trend in plants where there are numerous degreasers installed on continuous cleaning production is to use a centralized still with complete facilities for storage and handling of contaminated and clean solvent.

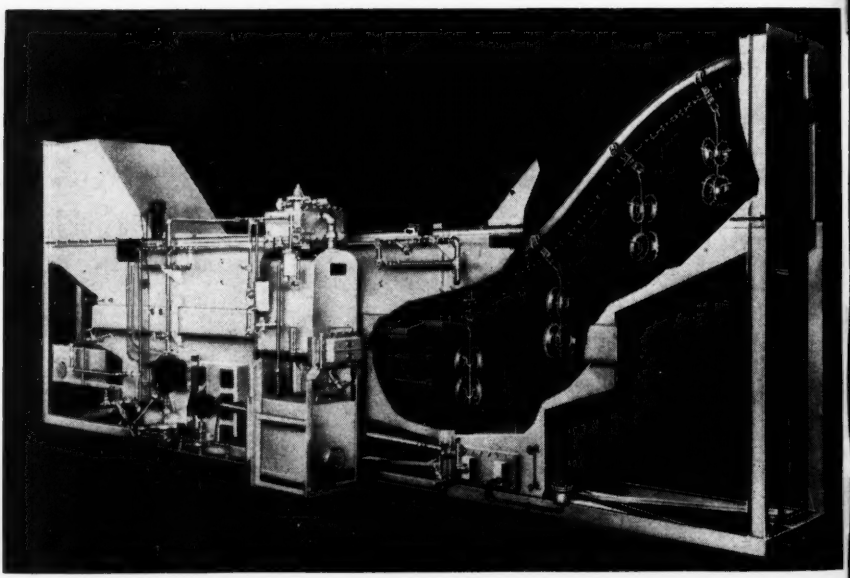
Solvents Recommended

Various chlorinated hydrocarbon solvents have been used for the degreasing of metals. Trichorethylene is now accepted by leading industrial authorities as one of the best and the most suitable of all of the chlorinated solvents for metal degreasing. Trichlorethylene is most satisfactory to stabilize for continous use in degreasing equipment. Today, it is stablized to different degrees and marketed under trade names to meet the various requirements of industry.

In the stabilization of chlorinated solvents, it is well to bear in mind that the stabilizers must be present in the vapor and all liquid phases throughout the degreaser as well as in the heated chambers. Otherwise, when two or more tanks are employed in the design of the machine, the solvent might be evaporated, and the stabilizer left in the boiling chamber.

In the stabilization of chlorinated solvents, various conditions had to be overcome to prevent the solvent breakdown; that is, the setting free of hydrochloric acid when the solvent is subjected to heat, light, moisture, air and the reactions caused by the combination of various metals that have been cleaned, as well as various types of soil removed in the degreaser. All of these difficulties have been

Fig. 4—The machine illustrated here is a through-type, vapor-spray-vapor degreaser equipped with a monorail conveyor, which ties in with the main conveyor system to provide a fully automatic cleaning cycle.



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definitely overcome in proportion to the degree of stabilization, except breakdown due to actinic rays, and excessive heat. However, for commercial use, the number of failures due to either of these last two causes is not serious, for rarely, if ever, does the solvent come in contact with light of sufficient intensity to cause decomposition, and safe temperatures are easily maintained in modern degreasing equipment.

The different degrees of stabilization of trichlorethylene referred to above enable industry to select the proper degreasing solvent for any cleaning problem.

Normally stabilized trichlorethylene solvent has been found to be satisfactory in single-tank machines on nearly all types of cleaning, except where large quantities of magnesium or aluminum are being cleaned. Under certain controlled conditions it also can be used in machines of two or three compartments. Highly stabilized trichlorethylene is stabilized to such a degree that it is suitable for use in any type of degreaser without fear of decomposition even though used with any combination of metals.

The Testing of Solvents

A simple positive field method for testing the degree of stabilization of chlorinated solvents, as measured by the alkalinity, is as follows:

1. Take 100 cc. of solvent, and add to it 100 cc. of distilled water.
2. Shake this mixture thoroughly and add a few drops of methyl orange indicator.
3. Slowly add to the mixture one-tenth normal hydrochloric acid from burette; shaking thoroughly after each reading.
4. When the pink tint, which indicates the end point, will not disappear on thorough shaking, the burette should give a measure of relative stability. This procedure involves the use of inexpensive and readily available glassware and chemicals.

Specifications for Degreasing Solvents

Highly Stabilized Trichlorethylene

Specific Gravity: At 15 deg./4 deg. C. shall be between 1.465 and 1.475

Distillation: Shall show the following: Initial Point . . . Min. 84.4 deg. C.; 95 per cent or better shall distill over between 84.4 and 90 deg. C.

Free Chlorine: None.

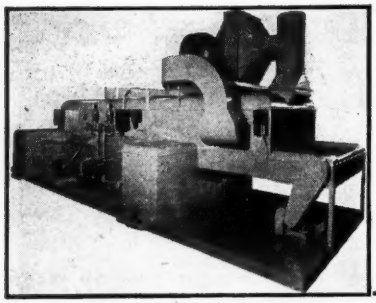
Water Content: Shall be such that the trichlorethylene may be cooled to—10 deg. C. and allowed to come to room temperature without cloud formation.

Non-volatile Matter: Shall not exceed 0.03 per cent by weight.

Normally Stabilized Trichlorethylene

Specific Gravity: At 15 deg./4 deg. C. shall be between 1.472 and 1.476.

Distillation: Shall show the follow-



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ing: Initial Point . . . Between 86.5 and 88.0 deg. C.

Free Chlorine: None.

Water Content: Shall be such that the trichlorethylene may be cooled to—10 deg. C. and allowed to come to room temperature without cloud formation.

Non-volatile Matter: Shall not exceed 0.02 per cent by weight.

Perchlorethylene, also called Tetrachlorethylene, for Special Applications

Specific Gravity: At 15 deg./4 deg. C. shall be between 1.628 and 1.632.

Distillation: Shall show the following: Initial Point . . . Between 120.0 and 122.0 deg. C.

Free Chlorine: None.

Water Content: Shall be such that the perchlorethylene may be cooled to 0.0 deg. C. and allowed to come to room temperature without cloud formation.

Non-volatile Matter: Shall not exceed 0.02 per cent by weight.

If proper consideration is given to the type of degreasing equipment installed and to the kind of cleaning solvents that are used, good results in cleaning can be obtained; then one of the major problems in metal finishing is satisfactorily overcome. Start with a clean surface and subsequent processing of metal will be simplified, less costly and with fewer rejects.

(Illustrations courtesy Detrex Corporation)

"Near Infra-Red in the Aviation Industry" is the title of Section 3 of the Encyclopedia of Near Infra-Red, prepared by The Fostoria Pressed Steel Corporation. The booklet is filled with interesting data on infra-red installations in the aircraft industry. Each case history includes a photograph or drawing, together with details regarding the operation performed; the name of the plant is given in each instance. A copy of the booklet may be obtained by addressing a request to The Fostoria Pressed Steel Corporation, Fostoria, Ohio.

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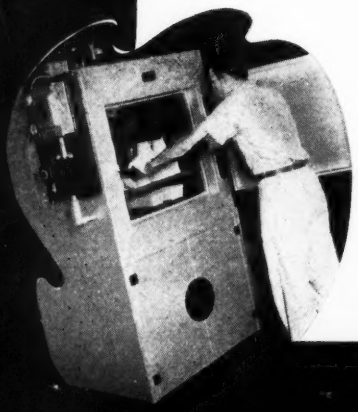
Hot Times for Metal F

By JOHN E. HYLER

SO MUCH variation exists in finish baking practices today that the manager or other factory executive coming newly to a consideration of this field is apt to be at a decided disadvantage in the selection of a method and of the type of equipment best suited to his particular needs. If he has been out of touch with the field for a couple of decades, he may even suppose that steam, for instance, is not adapted very well for heating ovens to the temperature required (say 400 degrees F. or more) for certain types of finish baking. It should be remembered, in this respect, that modern heating elements suited for application to finish baking ovens heated by steam have substituted copper tubes or coils for those of iron pipe. Copper has a much greater coefficient of heat conductivity. In addition, some installations have been encountered in which copper tubing has been provided with spirally wound radiating fins, which radiate heat into an oven in the same way that cooling fins radiate heat from the cylinders of air-cooled engines.



It is wise to remember that where metal parts or equipment are being bake-finished, the amount of heat radiation in an oven may not be taken directly as the standard of efficiency at which the finishing material will bake. The problem is based just as much on a build-up of temperature in the metal parts that are being bake-finished, though direct radiation of heat to the finish coatings must also be taken into

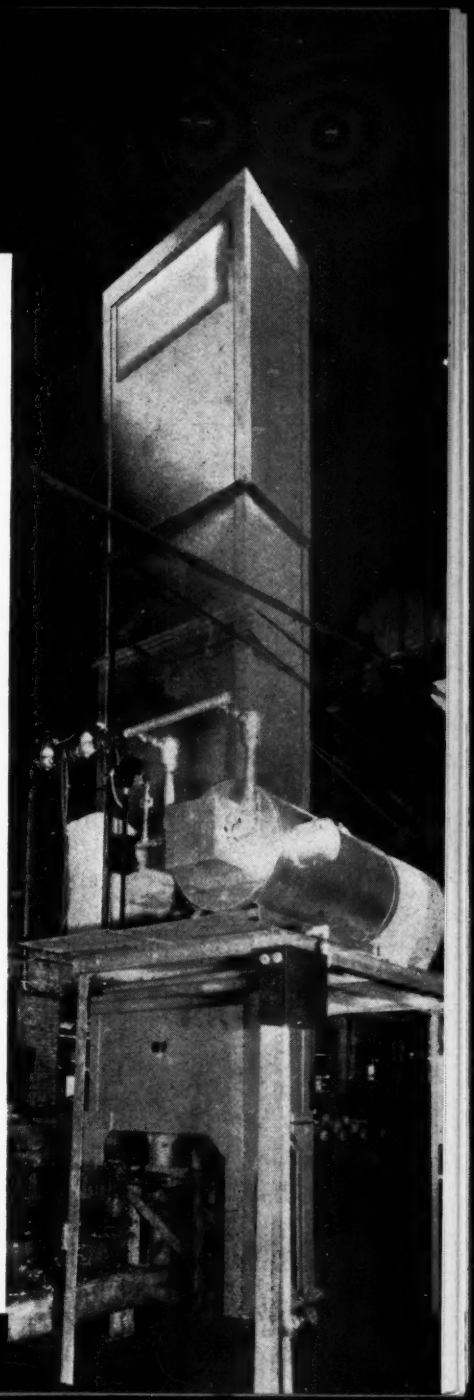
Metal Finishes

account. Therefore, in order to arrive properly at the efficiency of a bake-finishing oven or process where metal parts are being handled, as much or more depends on the use of a surface-reading pyrometer applied to the parts being finished as to a thermometer in the oven itself.

Where metal parts contain a considerable bulk of metal, the build-up of heat in the parts themselves will require more time and heat application than where the parts are relatively thin. However, it is also true that once heat is built up in such parts, it will abide longer after the parts have left the oven. This fact must also be taken into consideration in working out a proper schedule.

Overhead Chain Conveyors Expedite Baking

The overhead-type of chain conveyor has been assuming more and more importance of late years in handling metal parts through enameling and baking processes. Such conveyors are of particular benefit from two different standpoints. They conserve floor space because, in many cases, the material can be carried along up close to the ceiling and the space beneath the conveyor utilized for other purposes. Again, the chain conveyor is versatile in that it can and does often combine processes having to do with acutal application of finish coatings with the baking of these same coatings. Thus, one handling of the



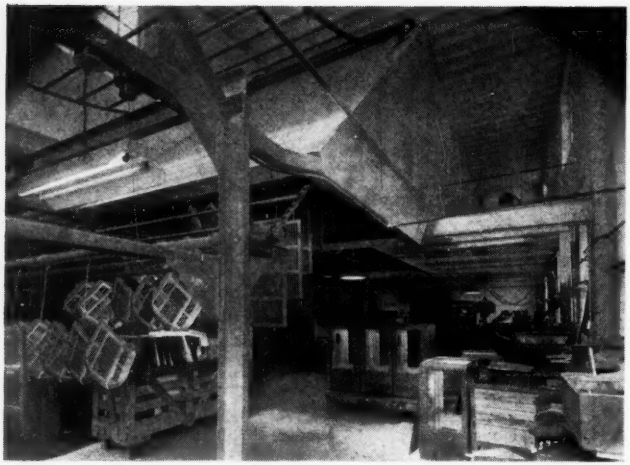


Fig. 1—Despatch continuous conveyor A-type oven in which the material enters the oven on an upward grade, is carried along on the upper level and emerges on a downward grade. The parts shown here are leaving the oven after being baked.

stock suffices for a number of finishing operations.

One installation may be cited in which a continuous chain conveyor of the double-chain type, with crossbars spanning the two chains and with the pieces being finished suspended from these crossbars, carries the material through three separate dipping and three separate baking operations before it is unloaded from the conveyor. The arrangement is such that the conveyor traverses a drop section in the track immediately after the stock is loaded. This drop section lets the material down into a V-shaped dip tank containing japan, thence upward and on into an A-type, indirectly fired gas oven, where the coat is baked as the conveyor moves on.

Emerging from this first oven, the material encounters another drop section in the track combined with another dip tank, and the process is repeated until three coats of japan have been separately applied by dipping. Each coat is separately baked in between the dipping operations. Layouts

Fig. 2—Panels are spray painted in the booth at the right and then placed on the Link-Belt conveyor, where they travel at the rate of one foot per minute beneath the battery of 96 infra-red lamps.

of this kind are not new so far as men experienced in the installation of finishing systems are concerned, but they are entirely new to many who have not seen or heard of such installations.

Obtaining the benefits of crossbar operation between two chain conveyor strands makes it necessary to limit the travel of the conveyor to one plane. Consequently, in a layout like the one mentioned above, the return or idle run of the continuous conveyor must be either arranged to pass directly beneath or directly above the working strand, combining the various operations that may be involved. In the case described previously, the return run of the conveyor was above the working run.

Figure 1 shows a continuous conveyor A-type oven in which the material enters the gas-fired oven on an upward grade, is carried along an upper level, and emerges on a downward grade. Such construction holds the heat confined on the upper level, but permits the use of open ends. In the illustration, the work pieces are leaving the oven and are ready to be unloaded. The heat seals at the ends cut off escape of heat. The entire oven is sufficiently high to allow the space beneath it to be fully utilized as working space. The double-strand or "match-strand" conveyor system is used, with cross rods for supporting the work.

It should also be remembered that many finishing operations make use of single-strand conveyors and where this is the case, the modern type of overhead conveyor chain may be routed up or down, to right or left, as the existing conditions indicate. Such single-strand chain conveyor layouts are the ones most frequently seen in use and have wide versatility in finishing departments. Racks of various kinds can be suspended from hooks on a overhead chain, and it therefore becomes possible, by the careful designing of such racks, to make a conveyor of this kind adaptable for handling many types of products. In some cases, chains of this kind are routed through spray booths of the water-wash type and from there through baking ovens.

Fig. 3—A portable infra-red drying unit of the type made by North American Electric Lamp Company is handy for use where small areas are to be dried, such as in patch work.

In one layout observed by the writer, racks of various kinds were suspended on swiveling hooks mounted on a chain conveyor so that they could be readily turned for spraying all sides of the workpieces as they passed through the spray booths. The parts then proceeded directly through a gas oven for baking of the sprayed finish, the oven being more than 100

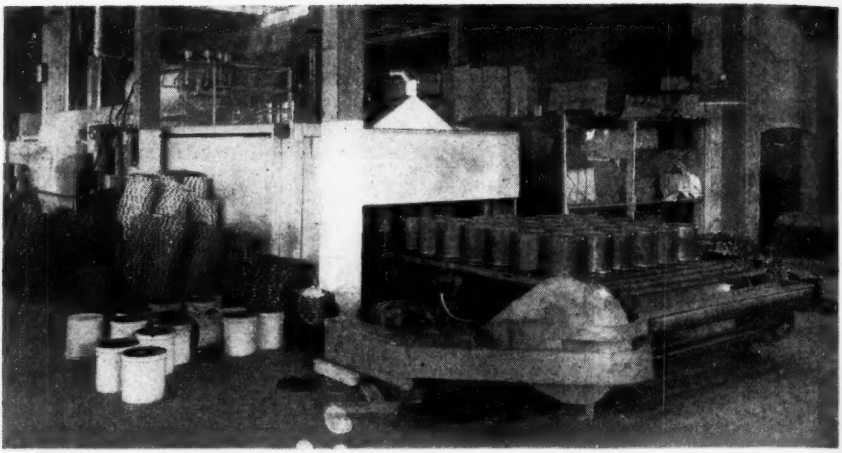


Fig. 4—This Despatch gas-fired oven is equipped with a slat-type conveyor which carries containers through the oven in such manner that finishes can be baked on both the inside and outside surfaces of the containers.

feet long. This conveyor was fitted with a variable speed drive in order that the speed might be adjusted to meet either the required spraying or baking time.

Flat Conveyors For Flat Work

Where flat work is to be bake-finished, one good method incorporates the use of a flat, slow-moving conveyor, on which the material is laid after spraying on the enamel or other material used for finishing. Baking equipment for flat furnace panels is shown adjacent to a spray booth in Fig. 2. The outer side of each panel receives two coats of paint and is spatter-finished. Placed on the conveyor after the spraying operation, the panels travel at the rate of one foot per minute beneath a battery of 96 infra-red lamps. The additional length on the conveyor in the foreground is provided so that the panels will be sufficiently cool to handle by the time they reach the end of the conveyor.

Portable finish-baking units of the infra-red lamp type are becoming increasingly popular; they have banks of lights which are adjustable both for height and for angular position as to the plane they occupy. Thus, work processed on a flat conveyor, though it has different angular work facets on the top side, may be baked by this process.

A five-light portable infra-red unit for small-area drying, such as patch work, is shown in use in Fig. 3.

The design of the direct gas-fired oven presented in Fig. 4 includes a slat-type conveyor, which carries metal containers through the oven in such manner that finishes can be baked on both the inside and outside of the work. A forced convection heating system is used which forces the air uniformly and in large volumes around the parts to be processed. The section of the conveyor shown in the illustration is the outfeed end; a forced air curtain system at the open end of the unit prevents undue escape of heat.

It should not be forgotten, of course, that the formulation of a proper baking finish is of just as great importance as the baking equipment that is used, and the use of a proper baking

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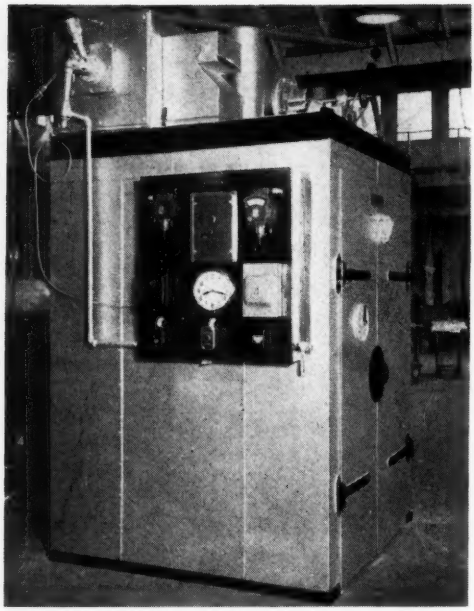

Fig. 5—Complete truckloads of material are handled in this batch-type gas-heated oven manufactured by George Koch Sons, Inc. The oven is fitted with specially-designed nozzles for equitable heat distribution.

schedule. Firms that manufacture good bake finishes are usually helpful in giving specific recommendations as to the correct baking schedule under given conditions. The temperature-and-duration factor will be less in most instances, when using infra-red lamps than when baking in ovens under other forms of heat, since the infra-red rays are more penetrating. As a case in point, one firm that is producing a highly efficient wrinkle finish with a linseed oil base, recommends 30 minutes at 300 degrees F. baking time for ordinary oven practice with this particular finish, but only 20 minutes at an appreciably lower temperature is required to bake the finish hard under infra-red lamps.

However, some finishes require the same drying and baking schedule, whether it is done in a convection-type oven or by infra-red lamps. A sprayed vitreous coating, for instance, which is suitable for application to to metal and can be supplied in Army drab, Navy gray or black, has a recommended schedule of 200 degrees F. for drying and 350 degrees F. for baking, regardless of the type of

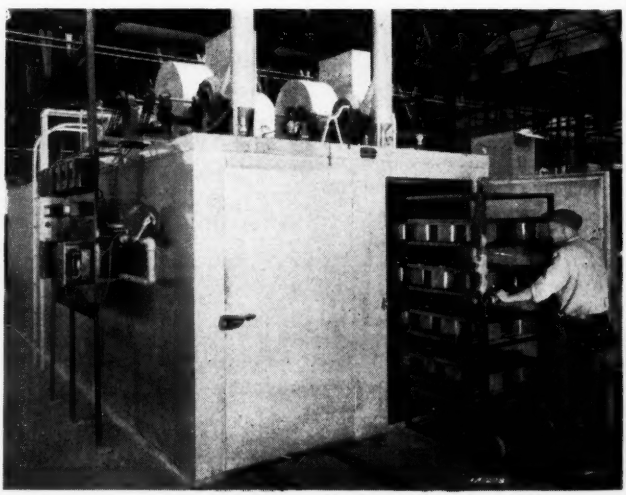

Fig. 6—Another oven which can accommodate truckloads of material was designed by Kirk & Blum Mfg. Co. The maximum temperature capacity of this direct gas-fired unit is 550 degrees F.

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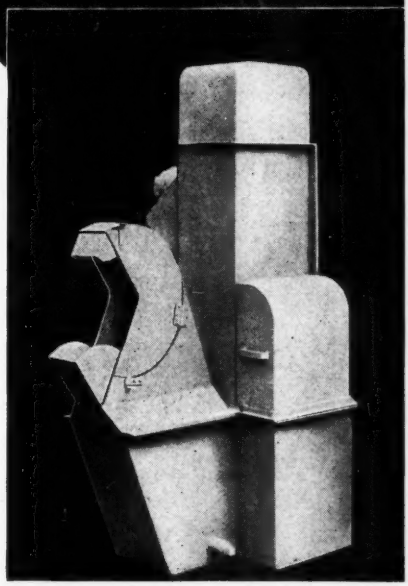

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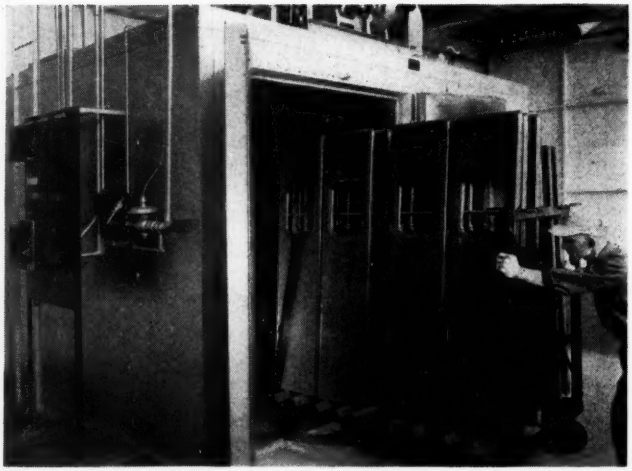


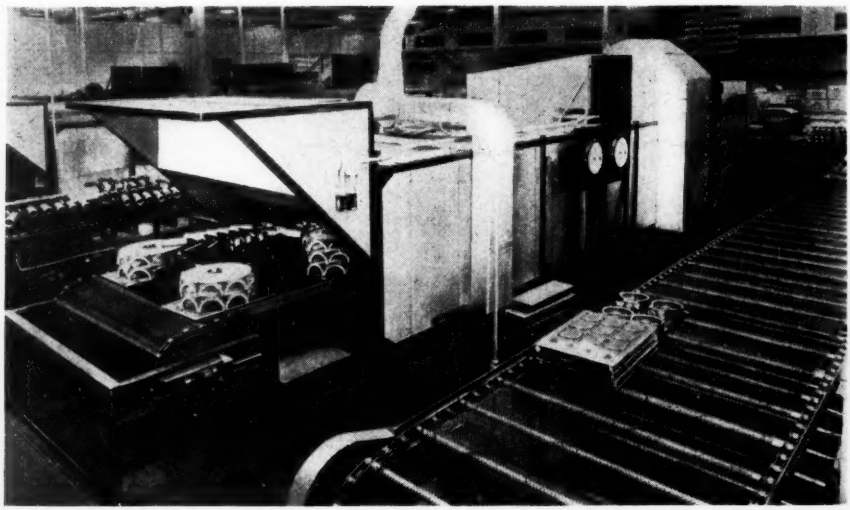
Fig. 7 — This double door paint baking oven, which has a capacity of 500 degrees F., is a product of Kirk & Blum Mfg. Co.

baking equipment used. The surfaces may be prepared to receive this finish in a variety of ways, including sandblasting and pickling. The finish itself is highly protective and produces a dull finish that may be buffed to an egg-shell gloss if desired.

Spraying and Baking Small Items

Numerous small items which require a high quality finish can best be finished by spraying; the parts must be kept separate from each other during the spraying and baking operations. One method by which this can be done is to fasten them to a medium which will hold them apart.

Fig. 8—Designed and built by The Gehnrich Corporation, the oven shown here is used for baking the paint finish on airplane motor parts. Incorporated in the design is a 40-foot conveyor with wire mesh belt.



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The finishing of shoe eyelets affords an example of this method. The eyelets are dipped in japan and then fastened to cardboard sheets, on which they are kept while the japan is being baked in an electric oven, and while a number of coats of enamel are applied afterward, each coating being separately baked at temperatures approximating 300 degrees F. Many other very small items on which a very high quality finish is necessary can be handled in a similar manner.

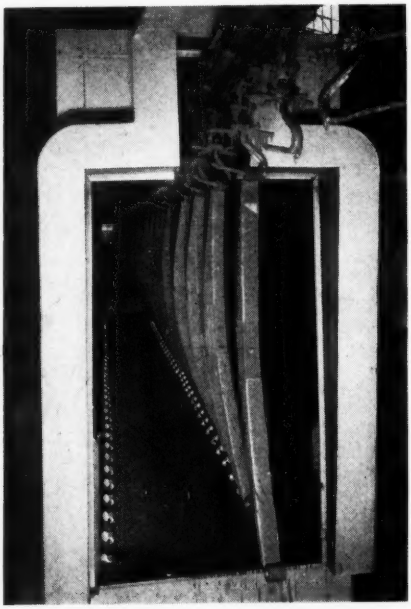

Fig. 9 — Gas burners that generate infra-red rays, a product of Burdett Manufacturing Company, are featured in this oven in which olive drab paint is baked on Army reconnaissance truck springs.

One type of baking oven is designed to receive truckloads of material, rather than stock that is traversed through the oven by conveyor; some items are handled better in this way. An oven of the truck type which will accommodate a truck or special castered rack up to 4 feet wide x 4 feet 9½ inches deep x 6 feet high is pictured in Fig. 5. The oven is equipped with automatic starting devices, complete time delay relay for purging the oven of gas before the burners can be ignited, automatic sparking device for igniting the pilot light, and an indicating temperature control.

One example recently noticed was the baking of a dipped line of steel scaffolding in a modern oven of the gas-fired type. The oven is fitted with specially-designed nozzles for equitable heat distribution through all parts of the oven, a provision which is important and valuable. The company making this oven has many standardized units and is usually able to provide an oven to suit the specific requirements of any plant.

Other batch-type ovens are shown in Figs. 6 and 7.

Type of Heat Used

It is a fact that nearly any kind of heat applied in a finish baking oven may be considered as available over a temperature range of considerable scope. Leaving the newer infra-red lamp method out of consideration for the sake of a comparison of other types of heat, it may be said that steam coils are used more generally where temperatures not much over 300 degrees F. are desired in an oven, although special copper coiling makes higher temperatures available as cited in the earlier part of the article. Where temperatures ranging between 325 and 600 degrees F. are desired, designers usually turn to direct firing.

Air is circulated in both of these types of ovens continually while they are in use. Some ovens have open ends and others have closed ends, depending on the manner in which the stock is handled into and out of the ovens. When the open-end type of oven is used, more heated air must be circulated in the oven to offset the effect of the openings. The air usually

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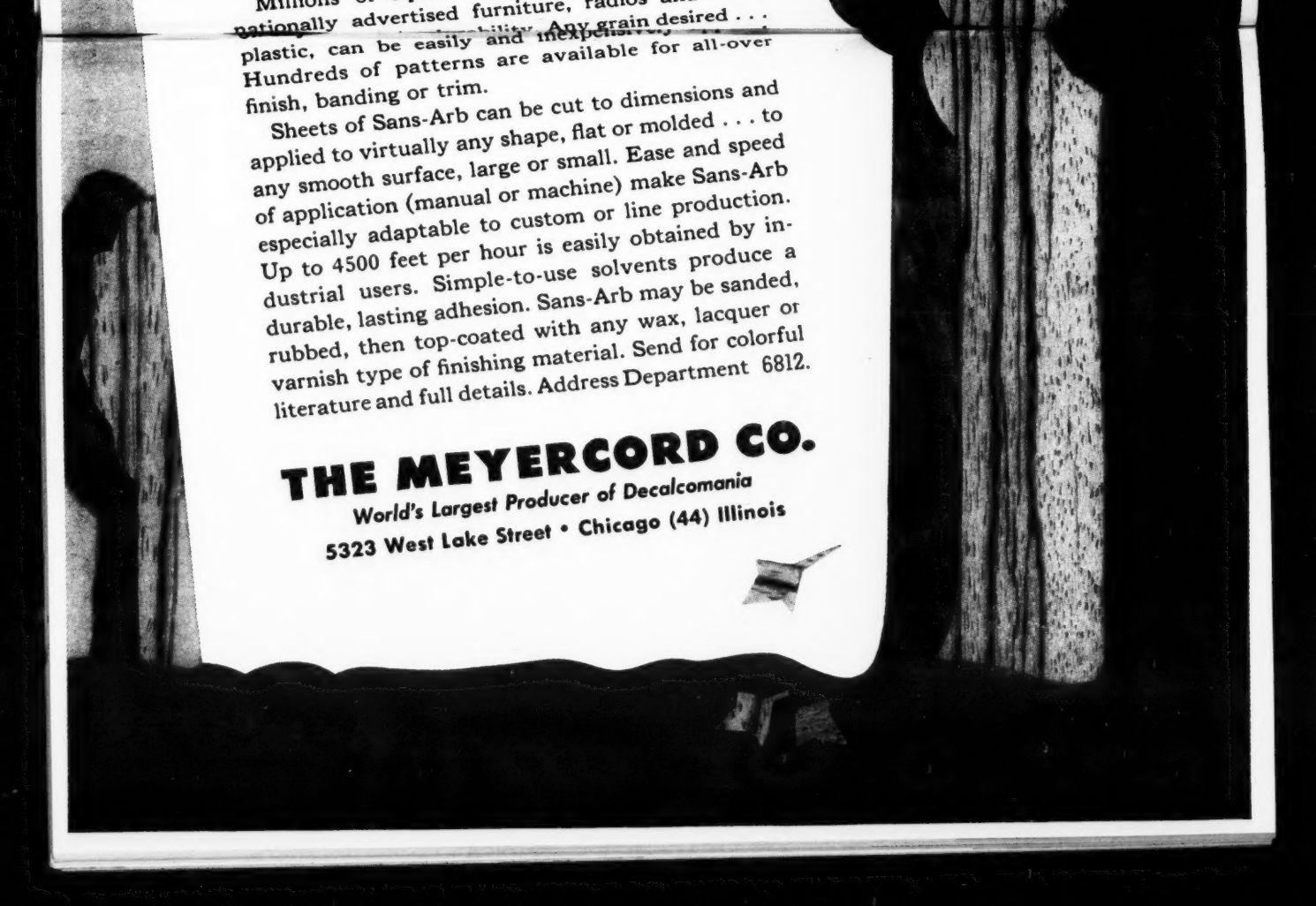
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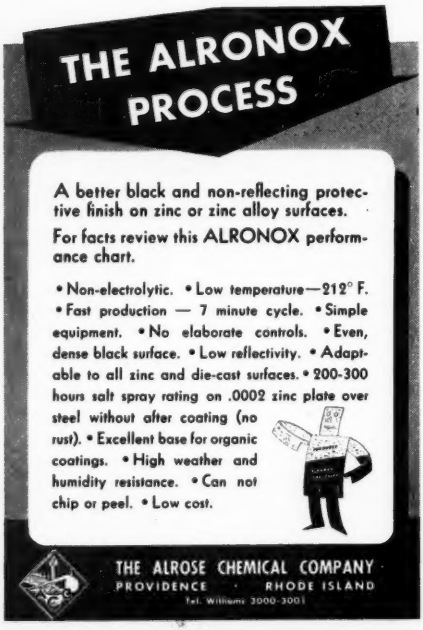
becomes laden with the fumes and moisture from the baking process and, as a result, it is almost always necessary to vent some part of the air from the oven. In the case of porcelain enamel glazing, of course, the temperatures mentioned are nowhere nearly high enough. Electric ovens are the rule in the case of this kind of work and temperatures average around 1,500 degrees F., although they may be 100 degrees or so on either side of this mark.

A paint baking oven used for baking the paint finish on airplane motor parts can be seen in Fig. 8. The conveying medium employs two strands of heavy-duty steel roller chain, fitted with cross pipes, the latter supporting a wire mesh conveyor belt. The overall length of the conveyor is 40 feet. The oven, which is 4 feet 10 inches wide, has an 8-foot pre-heating zone where heat at 150 to 225 degrees F. is applied in sufficient volume to volatilize the paint solvents. The remainder of the oven, a 23-foot section, is electrically heated to approximately 350 degrees F. for actual baking of the work.

A recent development that is being found highly efficient with regard to the baking of finishes is the derivation of infra-red rays from a special type of gas burner. The burners are encircled with a special refractory element which has a well-rounded combustion chamber on one side. The arrangement of this chamber is such that an even degree of temperature is maintained across the entire expanse of radiation. Infra-red rays have an especially long wave length and are therefore particularly powerful and efficient in heat radiation.

The operation of baking paint on Army reconnaissance truck springs is performed at the Detroit Steel Products Company in an oven equipped with infra-red gas burners, as shown in Fig. 9. The oven temperature must not exceed the melting point of the grease, which is 226 degrees F. The coating is a two-millimeter thickness of olive drab paint, and the complete bake is accomplished in four minutes at 225 degrees F.

While there are many standardized types of ovens available to fill a variety of needs, a number of oven manufacturers will design, manufacture and erect finish baking ovens of any size or kind, high or low, gas or oil fired, electrically or steam heated, to meet the individual specifications of the customer.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The Chemistry of Electroplating

By Dr. C. B. F. Young, Consultant

Part 3

IN the two preceding issues two elements and several compounds have been studied. In the present article two oxides of carbon —carbon dioxide and carbon monoxide—will be discussed. Also, the elements found in the atmosphere will be studied. In the latter part of the article the theory of atoms and molecules is given and, finally, symbols of the elements are listed, and methods are proposed for writing chemical equations using the valence of the elements. The last part of this series is very important, as the subjects treated here are the basis for chemical calculations.

Carbon dioxide is always present in the atmosphere, varying from four parts per 10,000 to 1 per cent. Wherever there is combustion, carbon dioxide is produced. For instance, when illuminating gas, wood, coal, fuel oil, gasoline, or any material containing carbon is burned, carbon dioxide is formed. Animals also produce large quantities of carbon dioxide by the slow combustion of food. In the human body, for instance, oxygen is breathed in and carbon dioxide and water vapor are exhaled. The carbon dioxide comes from the oxidation of the foods which contain carbon. If this gas is passed through clear lime water, it unites with the same and produces a milky colored solution which is a precipitate of calcium carbonate. Therefore, the production of milkiness in lime water when carbon dioxide is passed through is a test for the material.

Ordinarily one would think that the air would become more and more concentrated with carbon dioxide due to the many fires which occur, converting carbon into carbon dioxide, and also the large amounts of this gas exhaled by animals. This, however, is not the case, for if the carbon dioxide in the city atmosphere is analyzed, it will be found that the quantity is no higher than that obtained from a sample of air from the country. The reason for this is that the plants breathe in carbon dioxide and use it for a food and breathe out oxygen, which is the reverse of the process taking place in animals. This can easily be proved if a green leaf is submerged in water and then placed in the sunlight. Soon it will be noted that bubbles appear on the surface of the leaf and are liberated. If this gas is tested it will be found to be pure oxygen.

Carbon dioxide may be prepared by placing hydrochloric acid over calcium carbonate. If this is done, it will be noted that gas bubbles appear in the solution and rush to the surface. If these are collected in wide

mouth bottles, experiments can be performed. Thus, if a lighted candle is introduced into a bottle containing carbon dioxide, the flame is extinguished. Therefore, it is logical to contend that this material does not support combustion.

Furthermore, it will be found that the gas will not burn. One would expect carbon dioxide not to burn or support combustion by the fact that it is the result of combustion. If a stirring rod is dipped into some lime water and withdrawn in such a way that a clean drop remains on the end of the rod and then the whole is lowered into a bottle of the carbon dioxide, it will be noted that the clean drop becomes cloudy or milky. If a beaker is balanced on a scale, then some carbon dioxide poured into it, one will notice that the balance shifts over and the beaker gains weight. This shows that carbon dioxide is heavier than air. If some litmus paper, which is an organic dye, is introduced into water and then carbon dioxide bubbled through this solution, soon the litmus turns red, proving that carbon dioxide when dissolved in water is an acid.

When pure carbon dioxide is observed it will be noticed that the gas is colorless, odorless, heavier than air, and slightly soluble in water. The solubility increases with increased pressure and decreases with decreased pressure. The so-called "soft drinks" on the market today contain large amounts of carbon dioxide dissolved in water. Before opening the cap we note that no gas is visible, but the moment the cap is removed large quantities of the gas effervesce or bubble off. Carbon dioxide is a gas which will not support combustion or burn, as pointed out above. When dissolved in water it forms an acid called carbonic acid. Therefore, one would expect this gas to unite with lime or calcium hydroxide, which it does, forming a white precipitate of calcium carbonate. Calcium carbonate is the chemical name for marble.

Carbon dioxide, like water, has three states of material; namely, solid, liquid and gaseous. It is very easy to obtain this material in either of the three forms; thus, by applying pressure, carbon dioxide can be converted to the liquid form. Large tanks of this material are sold every day. If we open the valve and allow the liquid carbon dioxide to escape, it removes heat by evaporation and freezes the liquid carbon dioxide coming out of the opening to a white snow. In the industry this called dry ice or solid carbon dioxide.

Carbon dioxide is used in making soft drinks, and so on, and is also used to extinguish fires. The solid variety is used to produce low temperatures.

When materials containing carbon, or carbon itself, burn in an atmosphere that is limited in oxygen, carbon monoxide is formed. If the gas is analyzed it will be found that one volume of carbon unites with one volume of oxygen to give one volume of carbon monoxide. Unlike carbon dioxide, it will burn with a characteristic blue flame, forming carbon dioxide. This gas can be prepared in the laboratory by treating formic acid with some concentrated sulfuric acid. Carbon monoxide is a gas which is a little lighter than air and slightly soluble in water. It is colorless and always odorless when pure. It will burn with a characteristic blue flame, producing carbon dioxide. The gas is a reducing agent.

Carbon monoxide is a deadly poison. This is the material which makes the exhausts of automobiles so dangerous. One should never start an engine of a car with the garage doors shut. The daily newspapers report deaths occurring from this gas day after day. The gas is colorless and practically odorless when pure and for this reason one cannot see or

smell it, which makes it all the more dangerous.

If carbon dioxide is analyzed, it will be found that the weight of carbon compared to that of oxygen is to 2.66. On the other hand, if we investigate carbon monoxide it will be seen that this ratio is 1 to 1.33. Upon further examination it will be noted that 1.33 is one-half of 2.66. Therefore, it can be assumed that for a given amount of carbon, carbon monoxide has one-half as much oxygen as does carbon dioxide. This is indicated by the names of the oxides—dioxide, which is two oxides, and monoxide, which is one oxide.

It has been seen in our study so far that hydrogen and oxygen unite in two different ways; the ratio of hydrogen to oxygen in water, 1:8, and in hydrogen peroxide, 1:16. While carbon and oxygen unite also in two different ways, the weight of the oxygen combined with the carbon in the carbon dioxide is twice the amount combined with the carbon in the monoxide. In the first case the weights of oxygen which unite with one gram of hydrogen are in the ratio of one to two. This can be stated as follows: When any two elements, let us say A and B, combine to form more than one compound, the weights of B which unite with a fixed weight of A is in the ratio of small whole numbers. This is known as the law of multiple proportions.

We have already learned that approximately one-fifth of the atmosphere is composed of the gas called oxygen. Practically speaking, the rest of the atmosphere is composed of the gas which is called nitrogen. This element occurs also in the combined state. Nitrogen compounds are very important in many industrial operations and are absolutely necessary from the standpoint of agriculture.

As was stated above, about four-fifths, or 80 per cent, of the atmosphere is composed of nitrogen, the rest being composed of oxygen. It is easy to see that if oxygen is taken away from the air, about all that remains is nitrogen. It is true that the remaining compounds will not be pure nitrogen, but for our intent and purpose it will be good enough. The oxygen can be removed in several ways. If a metal is burned in the air, this unites with the oxygen present, forming an oxide, and in this way leaves nitrogen behind. Thus, by passing air over copper, iron, aluminum, and so on, which has been heated until very hot, the oxygen will be removed as cupric oxide, ferric oxide, or aluminum oxide, and the nitrogen will be left free. Another way to remove the oxygen would be to unite the element with phosphorous. Nitrogen is a very lazy element. It does not care to unite with the other elements or compounds and, if induced to unite, it desires to be in the free state again. Therefore, nitrogen compounds are very easily decomposed. For this reason nitrogenous materials are used as explosives.

As has been said above, nitrogen prepared from the air is not pure but contains other inert gases. This was not known until the year 1894. It has been found by careful research methods that nitrogen prepared from the atmosphere contains 1 per cent of impurities. This 1 per cent of impurities is composed of Helium, Argon, Neon, Krypton, and Xenon.

One of the best ways to prepare nitrogen in the laboratory is to pass ammonia over hot copper oxide and the first compound is oxidized to nitrogen and water. Another way is to heat ammonium nitrite, which decomposes into nitrogen and water. Due to the difficulty in preserving this compound we generally use in its stead two compounds, sodium nitrite and ammonium chloride, which gives the same results. Most of the commercial nitrogen is obtained by converting the atmosphere into a liquid.

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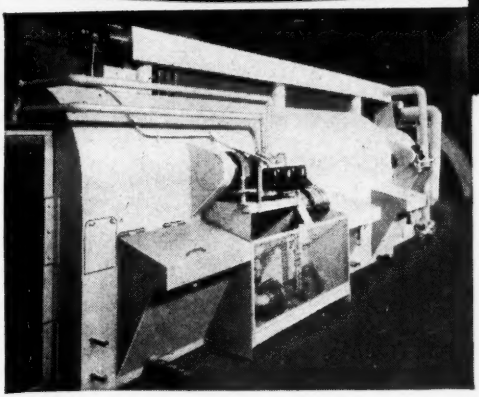

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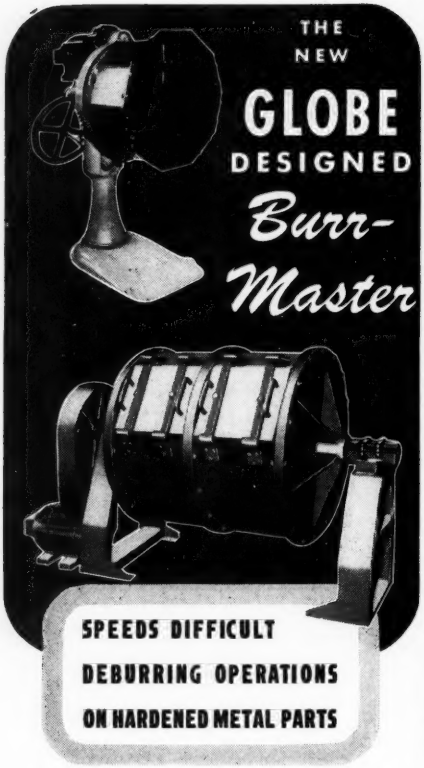

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If this liquid is allowed to evaporate back into the atmosphere the nitrogen is more volatile than the oxygen and is liberated first. In this way the two elements can be separated.

Nitrogen is a colorless, odorless, tasteless gas. It is just slightly soluble in water. Liquid nitrogen has a boiling point of —195.8 degrees C. As has been stated before, this is a lazy element. It does not support combustion and will not burn. At high temperatures magnesium, aluminum, and a few other elements unite with nitrogen to form nitrides. A very important reaction is the uniting of this element with hydrogen to form ammonia. In order for this to take place, high pressures and moderately high temperatures must be used.

Air is composed of nitrogen, oxygen, small amount of hydrogen, some carbon dioxide, water, and the rare gases which were mentioned a few paragraphs back. If the atmosphere is investigated it will be found that these elements are not combined, but are present only as a mixture. It is possible to separate the different elements by purely physical means. On the other hand, synthetic air can be prepared by putting these compounds together and, when mixed, there is no indication whatsoever that a chemical reaction has taken place.

In order to liquefy nitrogen it is necessary to use very low temperatures and very high pressures. It is found that it is impossible to liquefy a gas no matter how high the pressure, provided its temperature is above a certain point. This point is known as the critical temperature and varies for different gases. If air is to be liquefied, high pressures and low temperatures must be used, as stated above. It is quite possible, however, to convert air into a liquid just like water.

The most important use of nitrogen is in the production of nitrogen compounds. It can be used in electric

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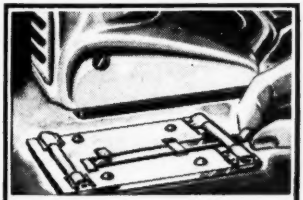

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light bulbs having a tungsten filament; the nitrogen, being very inert, does not unite with the wire, thus prolonging its life.

Argon, Neon, Krypton, Helium, and Xenon occur in the air in very small quantities. Cavendish, in 1785, noticed a small amount of residual gas when oxygen and nitrogen had been removed from the air. Lord Rayleigh, in 1895, observed that the residual nitrogen obtained from the air by the removal of the other known atmospheric substances was heavier than nitrogen obtained by the decomposition of its compounds. Sir William Ramsay found that a residual gas amounting to 0.93 per cent by volume of the sample of air resulted after the removal of all gases known at that time. The material thus produced was named Argon. The other gases were finally discovered after much research had been devoted to the problem. These elements are all very, very inert, even more so than nitrogen. So far it has been impossible to make them unite with other compounds.

Helium is next to the lightest substance known. It is twice as heavy as hydrogen, but not inflammable; therefore, it has largely supplanted hydrogen as the gas which is used for inflating balloons and dirigibles. Its buoyant effect is about 90 per cent that of hydrogen. There are no large sources of Helium. It has been found that natural gas in the Texas and Kansas fields contain in some cases one to two per cent. In 1930, the richest source of Helium yet dicovered was reported in southeastern Colorado containing 7 per cent Helium.

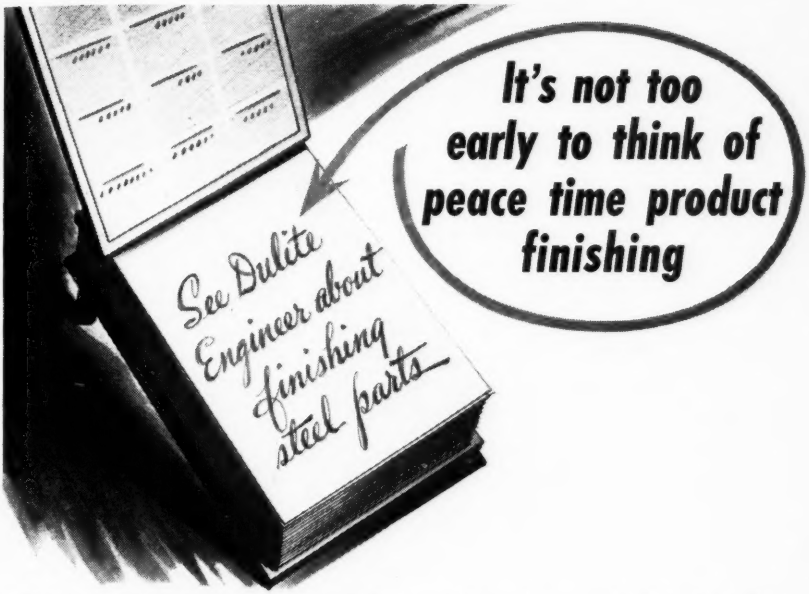
So far three very important laws have been studied. To sum these up we may state: (1) Law of conservation of matter. Matter can neither be created nor destroyed. (2) Law of definite composition. The weights of the elements combining to produce a given compound always combine in the same definite ratio. (3) The law of multiple proportion. When two elements combine to form more than one compound, the ratio of one material to the other can be represented by small whole numbers.

The three laws which have been stated above lead one to the fact that there must be some unit particle of matter for each of the elements. Common table salt acts like common table salt regardless of where it was mined. Table salt is composed of one part of sodium and one part of chlorine. The salt which is dug out of the mines in New York is identical with the salt that is pumped out of wells in Louisiana or Michigan.

There have been many attempts to picture how substances are composed in order to explain the facts as they are known. The Greek philosophers did work in this line. Leucippus and Democritus, in the fifth century B.C. put forth a theory of invisible atoms. They had no scientific facts to back their statement, but only the general scheme of philosophy. Undoubtedly, their work and the work of Newton influenced Dalton, who, in 1807, made public his atomic theory. Dalton did not distinguish between the atoms of an element and a compound.

The assumptions of this theory may be stated as follows: Elementary substances are composed of very small parts of matter known as atoms. All atoms of one material have the same properties, but atoms of different materials have different properties. Atoms of different materials combine to form compounds. Since Dalton put forth his famous theory it has been proved beyond a doubt by the large number of experiments which have been conducted that agree with the above statements.

The fundamental laws above can be explained in terms of Dalton's theory, provided one thinks on this matter. Suppose the laws are taken up in the order as they were stated above. The first law concerns the conservation of



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matter. This stated that matter could neither be created nor destroyed. Another way of stating this would be to say that one gets exactly what is started with, except that it has been changed in chemical form only. This is another way of nature telling us that it is impossible to get something for nothing.

Considering hydrogen and oxygen, two parts of hydrogen unite with one part oxygen to give two parts of water. In this case it can be seen that oxygen unites with hydrogen in a very definite way producing the familiar compound, water. If water be analyzed which is taken from the Atlantic or the Pacific Ocean, it will always be found that the hydrogen and oxygen will be in the above ratio; namely, two parts of hydrogen to one part of oxygen. All the oxygen will have a definite weight, all the hydrogen will have a definite weight, and always produces the same amount of water provided the same amounts of hydrogen and oxygen are used.

Now to explain the law of multiple proportion. In the above paragraph it was seen that one oxygen atom united with two hydrogen atoms to give water. It has also been found earlier that two oxygen atoms can unite with two hydrogen atoms, producing peroxide. In this case it will be seen that one has twice as much oxygen as in the case of water. This illustrates the law of multiple proportion.

If an element is subdivided until the smallest visible sample of it is left, this would contain a large number of atoms. Now if one continues to subdivide this portion until the smallest part which could take place in a chemical change is produced, an atom would be the result. The atom is a very tiny thing, impossible to see with even the most powerful microscope. Therefore, to talk about its weight would be absolutely silly. The chemist does not attempt to use the actual

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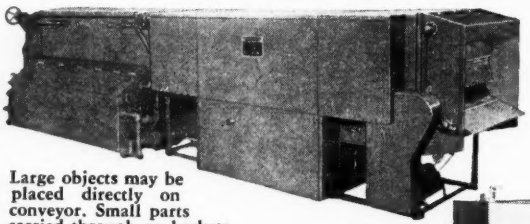

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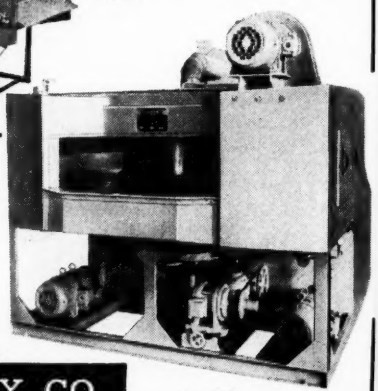

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weight of each atom, but he does use the relative weights of these atoms. Oxygen is chosen as a standard and its weight is assumed to be 16. Thus, one may find the atomic weight of an element is the weight of an atom of that element expressed in units chosen in such a way that the oxygen atom is equivalent to 16.

It will be noticed that the atomic weights of the elements are listed below. Thus, oxygen is 16, while hydrogen is one. This means that oxygen is 16 times heavier than hydrogen, or hydrogen is one-sixteenth as heavy as oxygen. Considering helium, the rare gas which was studied earlier, it has an atomic weight of four compared with oxygen. Therefore, it has the ratio of 4-16. Hence, oxygen is four times heavier, or helium is one-fourth as heavy as oxygen. Thus, in the case of water, it is known that two parts of hydrogen—that is, two atomic weights — combine with one atomic weight of oxygen, or they combine in the ratio of two hydrogen to 16 oxygen, which is a ratio of one to eight. In the case of hydrogen peroxide there are two parts of hydrogen combining with 32 parts of oxygen, which is 1-16 ratio. It can easily be seen that in the latter compound there is twice as much hydrogen as in the case of ordinary water.

	Symbol	Atomic Weight
Aluminum	Al	26.97
Antimony	SB	121.77
Arsenic	As	74.96
Barium	Ba	137.37
Beryllium	Be	9.02
Bismuth	Bi	209.00
Boron	B	10.82
Bromine	Br	79.916
Cadmium	Cd	112.41
Calcium	Ca	40.07
Carbon	C	12.000
Chlorine	Cl	35.457
Chromium	Cr	52.01
Cobalt	Co	58.94
Copper	Cu	63.57
Fluorine	F	19.00
Gold	Au	197.2
Helium	He	4.000
Hydrogen	H	1.008
Iodine	I	126.932
Iron	Fe	55.84
Lead	Pb	207.22
Lithium	Li	6.940
Magnesium	Mg	24.32
Manganese	Mn	54.93
Mercury	Hg	200.61
Molybdenum	Mo	96.0
Neon	Ne	20.2
Nickel	Ni	58.69
Nitrogen	N	14.008
Oxygen	O	16.000
Palladium	Pd	106.7
Phosphorus	P	31.027
Platinum	Pt	195.23
Potassium	K	39.096
Radium	Ra	225.95
Rhodium	Rb	85.44
Silicon	Si	28.06
Silver	Ag	107.880
Sodium	Na	22.997
Strontium	Sr	87.63
Sulfur	S	32.064
Tin	Sn	118.70
Titanium	Ti	47.90
Tungsten	W	184.0
Zinc	Zn	65.38

It has been pointed out that gases are composed of minute substances called molecules. In the common gases such as oxygen, hydrogen, chlorine, and so on, a molecule is made up of two atoms which are together by chemical combination. In the case of a compound such as steam, two parts of the hydrogen are united with one part of oxygen. Many of these molecules go to make up the compound which is known as steam, or when condensed, as water. It can be seen from the above that some molecules are composed of two or more atoms of the same element, while in the case of a compound, the molecule is composed of two or more atoms of different elements. In some few cases the gas consists of a molecule which is made up of one atom. These are said to be monatomic molecules. He-

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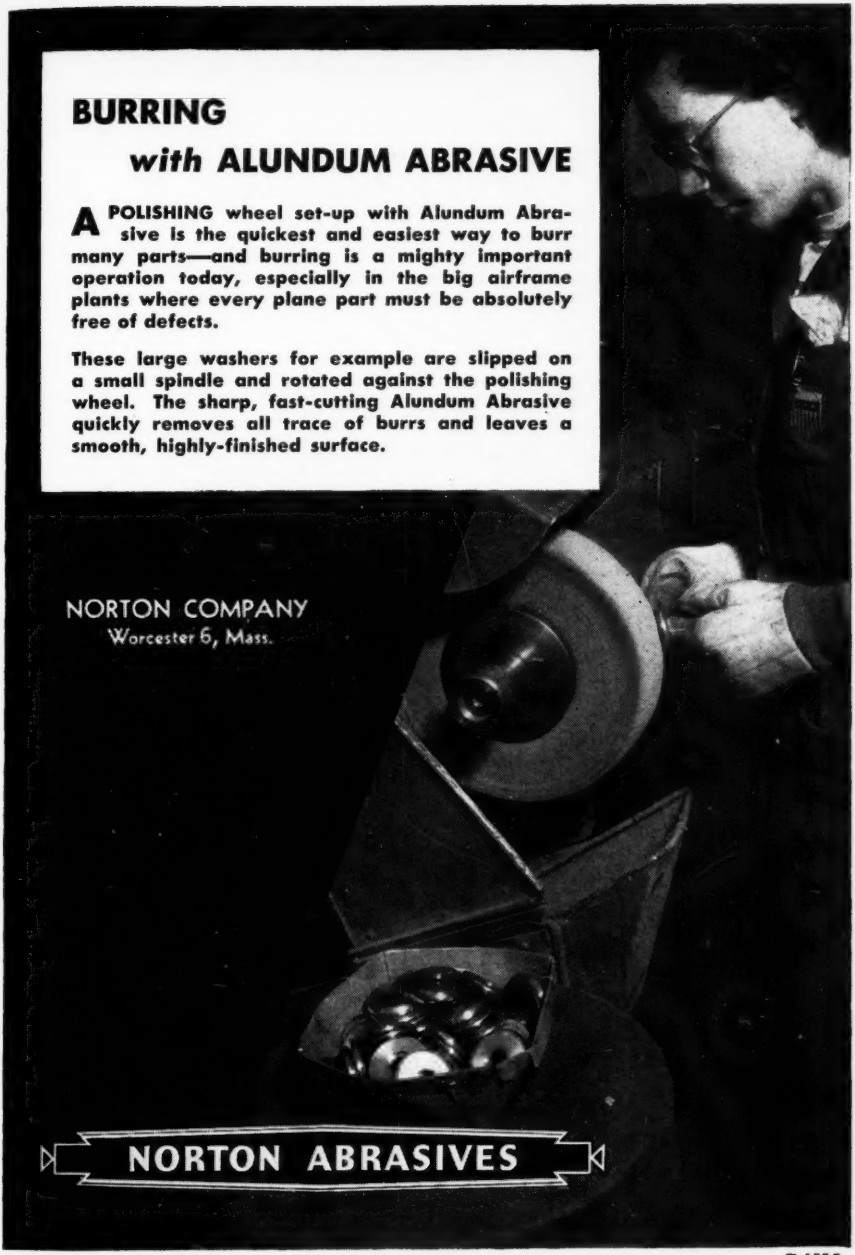

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lium and mercury vapor are examples of these.

If a block of ice is heated until it melts into water and the heating is continued, water will finally be transferred into steam. The change thus produced is brought about by the vibrations of the molecules in the compound. The vibrations of the molecules in the ice are slower than the vibrations of the same molecule in water. Also, the vibration of the molecules of the water are much slower than the molecules in the steam. It will be noted that the molecules going through these different phases have not changed chemically, but their physical characteristics have changed. If, on the other hand, one tears down the water molecule into hydrogen and oxygen by the passage of a current, then a chemical change takes place. An atom may be defined as the smallest part of an element which can take place in a chemical change, while a molecule may be defined as a smallest part of matter which can exist in the gaseous state.

The chemist has found that in writing the many reactions he has to write it is much easier to use symbols than words. For this reason he has adopted certain symbols to stand for chemical elements. Thus, H stands for hydrogen, Cl for chlorine, Na for sodium, Ni for nickel, Cd for cadmium, and so on. In some cases the first letter of the word has been chosen as its symbol, thus we have C for carbon, H for hydrogen, O for oxygen. Of course, this could not be the general rule because more than one element will begin with the same letter. For this reason cadmium is not known as C because this represents carbon, but is known as Cd. Cu stands for copper for this same reason. N stands for nitrogen. Therefore, nickel had to have some other symbol, which is Ni. And so one can go on down through the list.

At this point the student should become familiar with the symbols and atomic weights of the more common elements. The complete list is given above. One only needs to memorize the list given under atomic weights. The student should become very familiar with this list so that, if given the name of the element, he would be able to write out its atomic weight and symbol.

These symbols, besides being abbreviations for the elements, also carry definite quantities of matter with them. Thus Na stands for one atom of sodium and H stands for one atom of hydrogen, and so on. It can be seen that these are atomic symbols for the elements besides being abbreviations for them. It has already been pointed out that each atom has a definite weight so that the symbol stands for a definite quantity of that material. For instance, H means 1.008 parts by weight of hydrogen. O means 16 parts by weight of oxygen.

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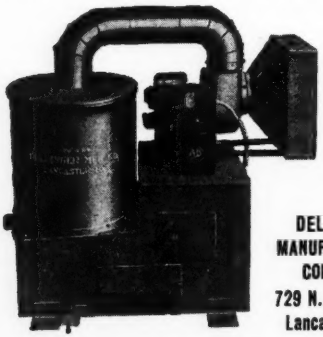

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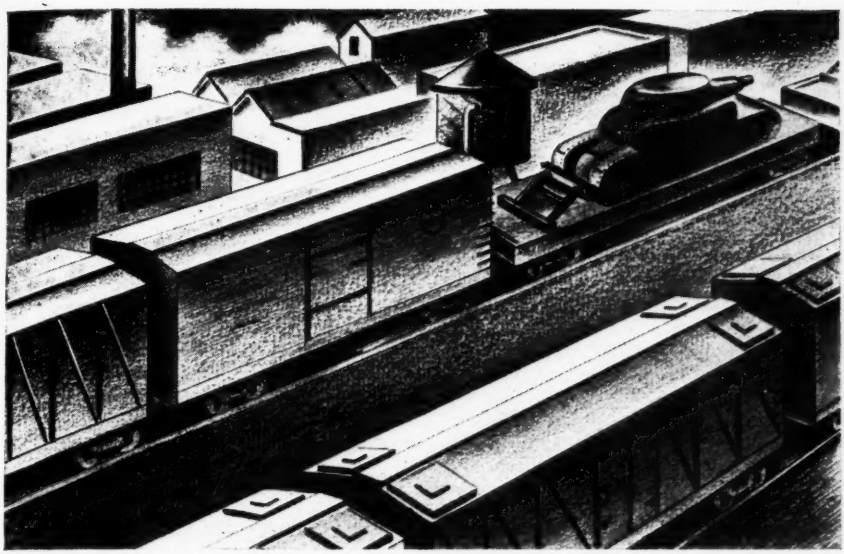

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In most cases oxygen exists in the molecular form consisting of two atoms of oxygen uniting to give one molecule of oxygen. Therefore, the symbol for a molecule of Oxygen is O. This symbol not only tells us that there are two atoms to one molecule of oxygen, but it also tells that there are 32 parts by weight (2 x 16) in one molecule of oxygen.

It is also possible to have a molecule of different elements, thus H_2O is water in the vapor state. This shows that one molecule of water is composed of one part of oxygen and two parts of hydrogen. It also shows that by weight it is composed of 1.008 x 2 = 2.016 parts of hydrogen and 1 x 16 = 16 parts by weight of oxygen. Putting these together we have 2.016 plus 16 = 18.016, which is the molecular weight of water. In order to make this clear, again a common compound with which the student is familiar will be used, namely, sulfuric acid. The chemical formula of sulfuric acid is H_2SO_4. Thus, sulfuric acid is composed of hydrogen, sulfur and oxygen. This formula tells the molecular weight of this compound is:

H — (1.008 x 2) —	2.016
S — (32 x 1) —	32
O — (16 x 4) —	64
	98.016

By adding the column, the molecular weight of the compound is obtained, namely, 98.016.

Many times a group of elements unite to form a radical and act as one element; that is, in many reactions they stay together. It is always possible, however, to break them up into their constituents if necessary. For example, SO_4 is a radical which is quite stable and is known as the sulfate radical. CO_3 is known as the carbonate radical. OH is known as the hydroxide radical.

When a systematic study of the elements is taken up and their methods of combining with each other ob-

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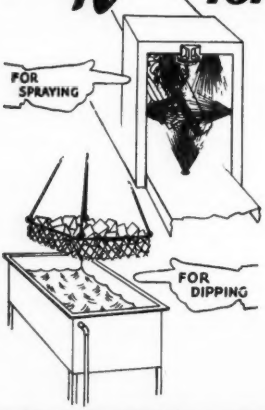

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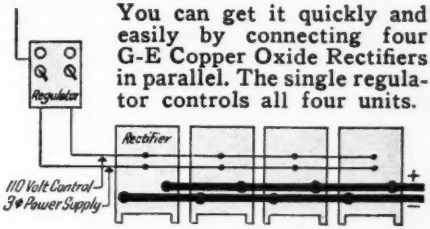

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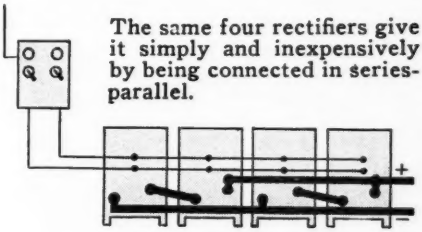
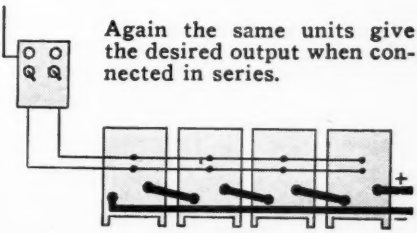
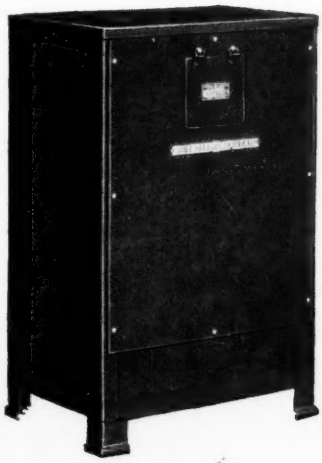


The same four rectifiers give it simply and inexpensively by being connected in series-parallel.

For **ANODIZING AT 500 AMPS 4-24 VOLTS**



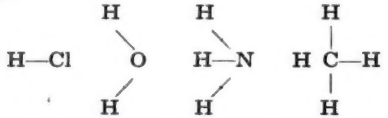
Again the same units give the desired output when connected in series.



OR FOR a great variety of other jobs, G-E rectifiers can be used with maximum efficiency. Output can always be increased or decreased. Further, they involve virtually no maintenance costs. Why not investigate the potential advantages of G-E Copper Oxide Rectifiers in your electroplating? Just write to Section A1233-70, Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

served, it will be found that they combine with each other in certain definite quantities. This was stated in an earlier chapter under the law of definite composition. It is found that different elements have different capacities. The chemist takes as his standard hydrogen which he assumes to be monovalent—that is to say, having only one arm or hook. To illustrate this we might look at the four formulas below. Thus, it is seen that one



hydrogen combines with one chlorine to form hydrogen chloride. Now if it is assumed that hydrogen is monovalent, then it must also be assumed that chlorine is monovalent, or that chlorine has one hook or arm with which to combine with other elements.

CARPENTER METAL BASKETS

CONVEYOR TYPE BASKET

Carpenter metal baskets are made to meet practically every cleaning, pickling, washing, and heat treating operation. They can be supplied in steel, stainless steel, Monel metal, and Inconel—in sizes and types to suit your needs.
Write for illustrated folder describing our complete line of baskets.

"If it's a metal basket we make it."

THE CARPENTER METAL PRODUCTS CO.
446 East 131st St. Cleveland, Ohio

The second compound, it will be noticed, has two hydrogens, which combine with one oxygen to form the compound, water. If hydrogen is assumed to be monovalent, we must assume that oxygen is divalent; that is, oxygen has two hooks with which to take on two other hooks. In the same manner it will be observed that nitrogen holds three hydrogen atoms. Therefore, it has a valence of three while carbon holds four hydrogen atoms, which gives it a valence of four.

This property is called the valence of an element. This may be defined as the number of hydrogen or chlorine atoms that an element will hold or displace in a reaction. For instance, magnesium combines with two chlorines; therefore, the former's valence is two. Sulfur combines with two hydrogens to form hydrogen sulfide. Therefore, its valence is also two.

Radicals, or groups of elements which tend to hold together, may exhibit a definite valence also. Thus, the sulfate radical consisting of one sulfur and four oxygens exhibits a valence all its own. A sulfate radical unites with two hydrogen atoms, producing sulfuric acid or hydrogen sulfate. Therefore, its valence is two. Other radicals also exhibit a definite valence. For instance, the nitrate (NO_3) has one valence, the chlorate (ClO_3) has one, the permanganate (MnO_4) has one, and the phosphate (PO_4) has a valence of three.

(Part 4 will be published in our January issue.)

Silco. An inorganic, vitreous-type, low baking point finish for steel, known as Silco, is described in a folder issued by Mitchell-Bradford Chemical Company, Bridgeport, Conn. Silco is applied with a low-pressure type spray gun and baked or cured at the low temperature of 350 deg. F. It is resistant to corrosion, abrasion, high heat, impact, scratch, acids, mild alkalis, and solvents. It is now produced in black, olive drab, navy gray and white and will be available in other colors after the war. Copy of the folder free upon request.

A Word
TO THOSE WHO PICKLE

CHEMICALS ACP PROCESSES

ACP Pickle Bath Toner is being utilized to improve the action of acid pickling and stripping baths in those cases where the use of Rodine is not indicated.

Pickle Bath Toner, supplied either as a liquid or powder, has little inhibiting effect and should, therefore, not be confused with the strong inhibitor, Rodine.

It, however, improves the effect of an uninhibited pickling or stripping bath. Among the improvements are:

Brighter and smoother surfaces
Reduction in drag-out
Better wetting of the metal
The removal of light films of oil
The formation of a thin, fume retaining blanket

ACP Pickle Bath Toner can be used alone in acid baths or with Rodine, the action and effectiveness of which is thereby enhanced.

Manufacturers of Inhibitors and Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP **PENNA.**

Note: West Coast Plants may address inquiries and orders for prompt delivery to: Leon Finch, Ltd., 728 East 59th St., Los Angeles, Calif.

American Chemical Paint Company, Ambler, Pa.
Please send me general Technical Service Data Sheets on

☐ Pickle Bath Toner ☐ Rodine

*Name*_____ *Title*_____

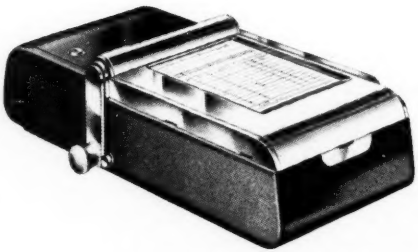
Company _____

Address _____

A-12

Quality Finish for Small Office Equipment

By CARLETON CLEVELAND



TO meet the requirements of a nation at war, the United Autographic Register Company, with plants in Chicago, Cleveland and Oakland, like many other manufacturers of office and industrial equipment has had to make certain changes in the finishing of its products — autographic registers used in connection with the writing of sales slips, shipping orders, bills of lading and a multitude of other record forms now so extensively used in maintaining correct and detailed accounts of all transactions.

There are six distinctive models in the company's line, ranging all the way from the lightweight type to the large cashier register. All but one (a plastic model) are of metal construction. On some the housings are one-piece stampings, while others consist of several stampings coupled with die castings—the various parts being completely finished before assembly.

The finishing of the metal models is practically the same in all cases. Cleaning the body metal by dipping in a cleaning solvent is the first step, after which the part is buffed to take out any nicks or blemishes. Thereupon a commercial filler coating is sprayed on. After sufficient drying, the part is placed on a continuous belt conveyor which carries it through a spray booth where it receives the finishing coat and a coat of lacquer. The piece then passes on into a gas-fired oven, the oven journey requiring some 40 minutes; the part is then ready to be sent to the assembly line.

The tops of some models of the registers are of white metal, one part being a die casting and another part shaped in a forming press and then punched for the opening which exposes the writing surface of the printed form to be filled in by hand writing. These white metal parts are first cleaned as is the body metal. Formerly they were given a chrome plating and then highly polished, but due to war restrictions they are now sprayed with enamel and baked. This is followed by a spray coat of burnproof lacquer, which acts as a protective coating against any acid action from perspiring hands of the operator of the machine, or from lighted cigarettes thoughtlessly laid on one of the convenient corners of the ma-

FLAWLESS ELECTROPLATING

Insured by New Double-Function Cleaner

PROSOLV B Cleans physically and chemically . . .

How clean is "Clean"?

Not clean enough in today's wartime zinc electroplating unless it includes *both physical and chemical cleanliness.*

Zinc plating, like cadmium or copper, will not adhere over traces of rust or scale. So – when work is cleaned for zinc plating–oxides, mill scale and corrosion products must be removed–as well as grease and dirt.

That's why TURCO'S new PROSOLV B cleaner is filling an essential need in American industry.

PROSOLV B goes to work in the cleaning tank like a fine precision tool. Its accurate, powerful action penetrates and removes grease and carbon smut, rust and scale. The resulting metal surfaces are physically and chemically immaculate . . . ready for a perfect plating job.

Try this specially formulated product that is solving plating problems in many warplants throughout the country. It is adaptable for practically any plant requirement because it can be used in any standard steel tank equipment.

SEND FOR DESCRIPTIVE LITERATURE TODAY

BUY WAR BONDS

Turco PRODUCTS INC.

TURCO

SPECIALIZED INDUSTRIAL CHEMICAL COMPOUNDS

MAIN OFFICE & FACTORY: 6135 SO. CENTRAL AVE., LOS ANGELES 1
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SERVICE MEN AND WAREHOUSE STOCKS IN ALL PRINCIPAL CITIES

54-123

chine. Many users prefer registers with the dull finished lid, as compared with the chrome finish because the dull finish does not have the glare of the bright metal.

For many years the company had rigidly held to a quality finish in green on all machines. This color was maintained as one of the readily distinguishable features and, in fact, a slogan had been adopted, "The green machine with the red hub." Now, however, due to modern ideas of harmony in office equipment and furnishings, the company is finishing the registers in different colors—black with ivory trim, gun metal color with a gray trim, and the original green with gray trim. With the exception of a gray trim on certain metal parts, the plastic model is green throughout. The pigment being in the mold, the completed machine requires no finishing, except for the trim.

All parts of the various models are

One of the Various Uarco Models

carefully inspected as they come from the finishing line, and again when the machine is completely assembled. After this, each machine is placed in a corrugated carton as a protection against scratches or nicking and is sent to the stock room.

Before shipment is made, each register is given a final rigid inspection and tested, using the customer's printed forms to make sure it operates satisfactorily in all respects. This is necessary because of variations in the numerous forms used in different types of business systems.

"The Invisible Work Glove for Industry," which protects the exposed skin surface against industrial dermatitis and is marketed under the trade name "Cadet Skin Kote," is the subject of a 16-page folder issued by Cadet Creme Company, 10 Clarence St., Worcester 5, Mass.

SPEED UP PRODUCTION!

Don't let a deburring problem lick you and slow up your production.

Consult a specialist in the field who is equipped to work out your problem.

Write today to:

LUPOMATIC TUMBLING MACHINE CO., INC.
4510 BULLARD AVE. BRONX, N. Y.

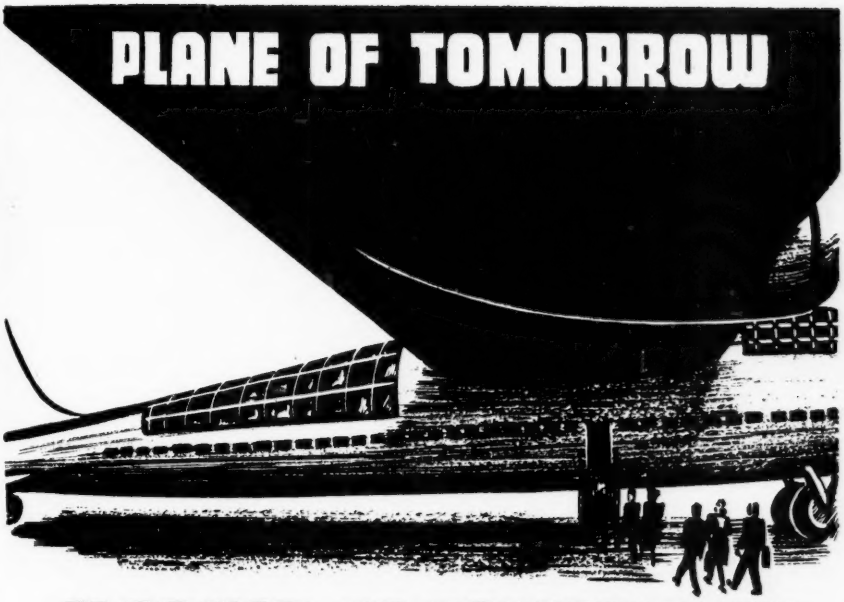
For a real good polishing job use

KEYSTONE EMERY

TURKISH — NAXOS — AMERICAN

KEYSTONE EMERY MILLS *Write for Sample* **4316 Paul St., Phila., Pa.**

PLANE OF TOMORROW



CLEANER OF TOMORROW

MAC DERMID Incorporated compounds are already becoming the accepted cleaning procedures for post war planning due to the exceptionally large number of formulations that have been perfected for war production and to the economy and perfection that can be obtained by using these *special treatment* compounds.

A MAC DERMID Incorporated representative will be pleased to help you with your post war planning — show you why ANODEX, METEX and METALEX are now used by so many war production plants and how these speedy, positive compounds can be used to your advantage — today as well as tomorrow.

Write for Free Data Sheets

MAC DERMID

INCORPORATED

WATERBURY 88, CONNECTICUT

WRITE ONE OF THESE SERVICE ORGANIZATIONS FOR FREE DEMONSTRATION

NEW YORK	DETROIT	CHICAGO	LOS ANGELES	CLEVELAND	ST. LOUIS	TORONTO—CAN.
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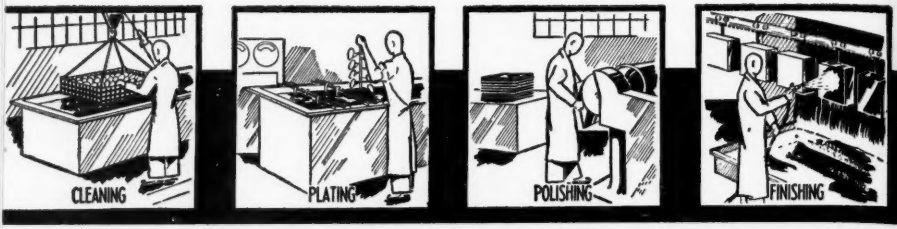
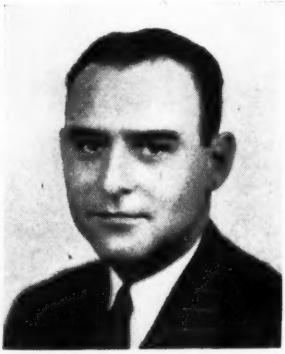


News of the Industry

W. F. Newbery Advanced by Detrex

W. W. Davidson, vice president in charge of sales of Detrex Corporation (formerly known as Detroit Rex Products Company), Detroit, Mich., has announced the appointment of W. F. Newbery as sales manager of the Industrial Division.



W. F. Newbery

Mr. Newbery started with the firm in 1934 in the Sales Division and covered all territories in the East, including special assignments in New England. After serving as eastern region manager for several years, he transferred to the midwest where he established headquarters in Dayton, Ohio, for the south central region. He brings to the main office and plant in Detroit wide experience in cleaning problems and applications, especially in the aircraft industry.

19th Exposition of Chemical Industries

The 19th Exposition of Chemical Industries is being held this year from Dec. 6th to 11th at Madison Square Garden, New York City. The show starts at 2 p. m. on Monday, Dec. 6th, and is open daily from 11 a. m. to 10 p. m., with the exception of the last day when it will close at 6 p. m.

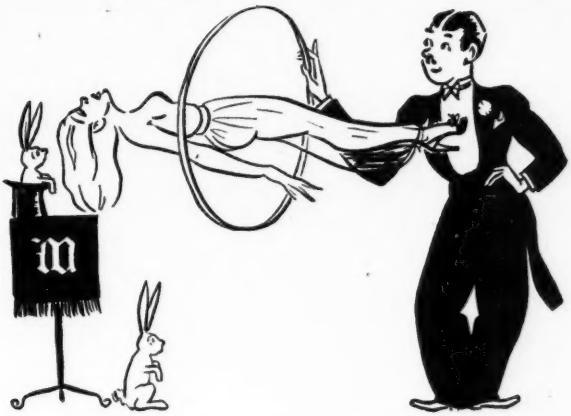
The exposition is a permanent organization whose purpose is to promote the relationships between research, industrial enterprise and the media of production through visualization and direct discussion. It serves a large group of process industries which apply chemical science and chemical engineering in changing material in the course of manufacture. A large number of interesting exhibits have been planned by industrial firms whose products are related to the chemical field.

Leever Made Sales Manager

MacDermid Inc., Waterbury, Conn., announces the appointment of Harold Leever as sales manager for this company. Mr. Leever was formerly western manager, residing in Ferndale, Mich., but will now make his headquarters in Waterbury.

Mr. W. D. MacDermid, former sales manager, is no longer connected with the company.

It's No Trick At All With TORIT



TORIT DUST COLLECTORS

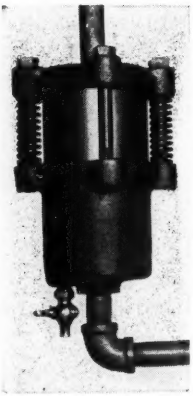
make the collecting of abrasive dust particles a simple matter. Portable and completely self-contained they are easily attached to existing machinery and, when necessary, they can be moved about to fit into new production layouts.

Torit Dust Collectors trap grinding dusts at their source and the cleaned air is re-circulated into the room . . . saving employes' health, valuable machinery and reducing heating bills. For complete information write:

TORIT MANUFACTURING CO.
314 Walnut St. St. Paul 2, Minn.

TORIT Dust Collectors
SELF-CONTAINED UNITS

CLEAN
COMPRESSED AIR



● Universal Air Filters have proven their superiority over many years' use on compressed air lines for removing condensed moisture, oil and other impurities.

The synthetic porous stone used as a filter medium (in addition to the well-known principle of centrifugal action) causes this filter to deliver pure, dry air for process use by the leading Industrials of the United States.

Two filter stones are furnished with each unit to assure continued operation during simple cleaning process. Maintenance is easy and inexpensive.

Write for detailed information and circular.

UNIVERSAL FILTER COMPANY
Manufacturers
7025 Manchester Ave. • St. Louis, Mo.

Baker Is Director of Electroplating

E. I. du Pont de Nemours & Company has announced the appointment of Samuel G. Baker as director of its Electroplating Division. He had been director of sales of the Explosives Department.

Samuel G. Baker

In his new position he will have charge of all electroplating activities of the Du Pont Company. Mr. Baker's service with the Du Pont Company dates from 1923. Since then he has been steadily in the employ of the Explosives Department. His service covered chemical, manufacturing and sales operations.

Mr. Baker was born in Tacoma, Wash., and is a graduate of the University of Washington in chemical engineering. He is a member of Tau Beta Pi and Sigma Xi, and the American Institute of Mining and Metallurgical Engineers.

Chicago A.E.S Annual Educacational Session and Banquet

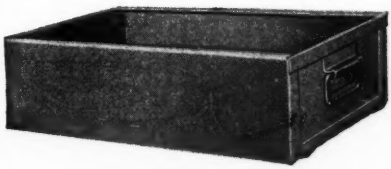
Saturday, Jan. 22, 1944, has been selected as the date for the 32nd Annual Educational Session and Banquet of the Chicago Branch of the American Electroplaters' Society; the place is the Palmer House. The educational session will be held from 2 p. m. to 4:30 p. m., and the banquet will start at 7 p. m. The tickets will be five dollars each and reservations may be made with the secretary of the branch, J. W. Hanlon, 3004 N. Whipple St., Chicago, Illinois.

Immediate Shipment
STEEL BOXES
FOR YOUR PRODUCTION NEEDS

STYLE 200 STRAIGHT SIDE SHOP BOX

A straight side shop box with drop handles each end. Excellent for shop use where stacking feature is not required.

No. 201—6"x 9" x3½"—20 ga., $.40 Each
No. 202—8"x12" x4" —20 ga., $.45 Each
No. 203—9"x13½"x4½"—19 ga., $.60 Each



STYLE 300 STACKING BOX

Just right for your small parts. Light in weight, easy to handle. Equipped with drop handles each end. Runners save wear on bottom of box and act as positive stacking lock.

No. 301—6"x 9" x3½"—20 ga., $.55 Each
No. 302—8"x12" x4" —20 ga., $.60 Each
No. 303—9"x13½"x4½"—19 ga., $.75 Each

STYLE 700 STACKING BOX

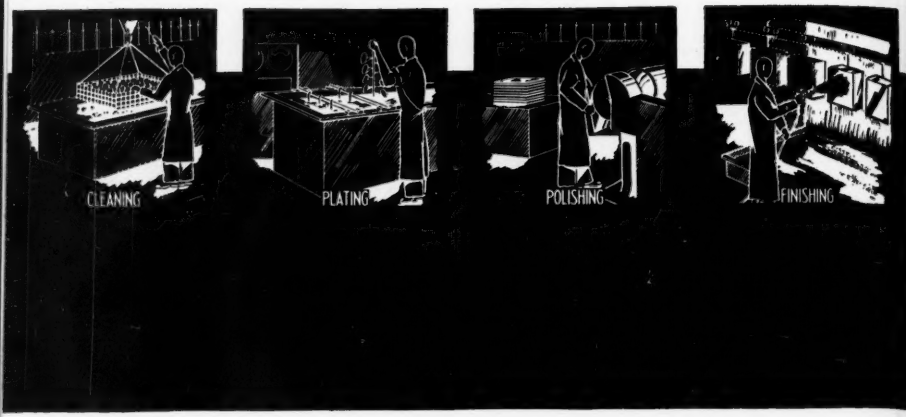
A light weight box designed for quick identification of contents. Will stack with No. 303. Finished olive green enamel, baked on.

No. 703—9"x13½"x4½"—19 ga., $.95 Each

Prices F.O.B. Factory, Philadelphia—Any Quantity! Order Today—Write, Wire or Phone.

AMERICAN METAL WORKS, INC.

1532 GERMANTOWN AVENUE **PHILADELPHIA 22, PA.**

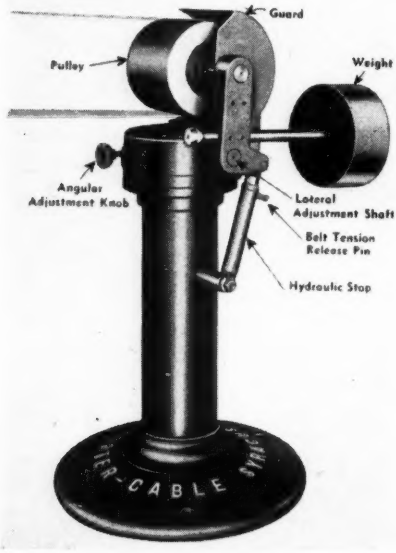


Porter-Cable Model ABS Backstand Idler

As an addition to its line of abrasive belt grinders, The Porter-Cable Machine Company, Syracuse 8, N. Y., announces the Model ABS Backstand Idler. This idler is used to adapt grinding and polishing lathes to abrasive belt grinding.

The backstand idler makes possible the use of an endless metal cutting abrasive belt, which is fast cutting, and desired finishes are easily obtained. Heat is reduced because of the long abrasive belt used. Lower temperature operation decreases such hazards as heat, discoloration, warping, fracturing, and so on.

Where it has been customary to grind, rough polish and finish on regular wheels, the same results are obtained by the abrasive belt method, but the rough polishing operation can be eliminated. The idler is recommended by the manufacturer for grinding welds, flash, generating radii, flat and edge work, cleaning up, polishing and similar operations. Any width belt up to 6 in. can be used.



Porter-Cable Model ABS Backstand Idler

Electroplating Production Stepped Up with Promat Process

In the electroplating plant of the Chicago Plating Company, 1714 W. Division St., Chicago, Ill., where plating of war products goes on continually it is reported that fast production schedules are being met by the use of a new process of electroplating known as the Promat Process.

According to A. L. Pietrowicz, in charge of technical development of the Chicago Plating Company, production has been more than doubled. The new process, he claims, gives improved anode characteristics and greater cathode efficiency and a finer grain deposit and brighter finish is readily obtained.

It is claimed that in the Chicago Plating Plant, a new and unique use is made of alterating current. A motor-driven

generator supplies direct current to the Promat Power Unit which is also supplied with alternating current. The Promat Power Unit produces an asymmetrical alternating current which is used as a power source with specially prepared high speed zinc plating baths. Both No. 90 and No. 99 Promat Processes are in use in this plant.

Promat Power Unit

A 12-page booklet illustrating and describing the process may be obtained by electroplaters who write to the Promat Division of Poor and Company, 851 S. Market St., Waukegan, Illinois.

Lubricoolant

The Du Bois Company, Cincinnati 3, Ohio, has announced the development of a cutting lubricant, to be known as "Lubricoolant." It is claimed that results on a variety of operations including grinding, cutting, facing, boring, drilling, threading, deburring, and so on, have indicated a prolongation of tool life.

The work is held at levels not measurably above room temperature. Elimination of "dry welding" of chips to the cutting edge of the tool is said to be achieved. Lubricoolant is absolutely transparent and thus facilitates a high degree of working accuracy. High working speeds are possible, and mirror finish work is obtained. Lubricoolant is also said to be completely free from objectionable odors and to aid in the elimination of dermatitis.

Aeroil Twin Dipmaster

Two hot liquid dip tanks in one portable unit feature the Twin Dipmaster developed by the Aeroil Burner Company, West New York, N. J., thus enabling the operator to clean and rinse metal parts and products without the necessity of carrying them to a second

Save Fingers with
Steel-Grip Finger Guards

Hundreds of factories are saving time and injuries in war production by protecting workers with Steel-Grip Finger Guards. Used for handling rough or sharp articles, for buffing, grinding, sanding, polishing, punch press work and hundreds of other jobs. Protect fingers or thumb, front or back, from cuts, abrasions or blisters. Made of durable leather with elastic web back for snug, cool, comfortable fit. Easy on and off. One size fits all, men or women. Send 10c each for samples or trial order box of 50 at 8½c each, less 10%. *Catalog of Steel-Grip Safety Apparel free on request.*

Famous Industrial Safeguards Since 1910

INDUSTRIAL GLOVES CO.
746 GARFIELD BLVD. DANVILLE, ILL.
Canada: Safety Supply Co., Toronto

tank for hot or cold rinsing. The unit plugs in on 110 or 220 volts a.c. or d.c. for instant heating.

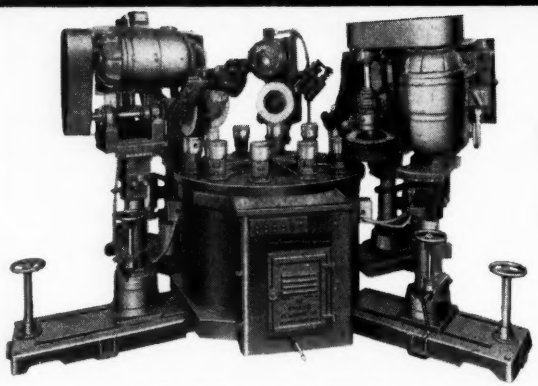
Equipped with two insulated compartments separated by a partition that is also insulated, the Twin Dipmaster has two removable immersion tube heating units (one for each tank) that deliver all the heat in the cleaning solution and rinse water. Separate, automatic heat control for each compartment is supplied by two thermostats regulating any required temperature from 110 to 550 deg. F.; the controls operate independently of one another. In addition, there are two built-in thermometers registering temperatures from 100 to 600 deg. F. and four dipping baskets.

Completing the standard equipment are scum gutters, draw-off cocks, an insulated cover, pipe connections for the addition of fresh water to the rinse compartment, as well as to drain off contaminated liquids, and two work

Aeroil Twin Dipmaster

Give your
COPPER STRIPPING PROBLEM
a Christmas Present
Try
McKeon's
"Liquid Sulphur"
SULPHUR PRODUCTS CO.
GREENSBURG PA.

Packer-Matic



No. 2-12—ROTARY INDEX.

Automatics At War!

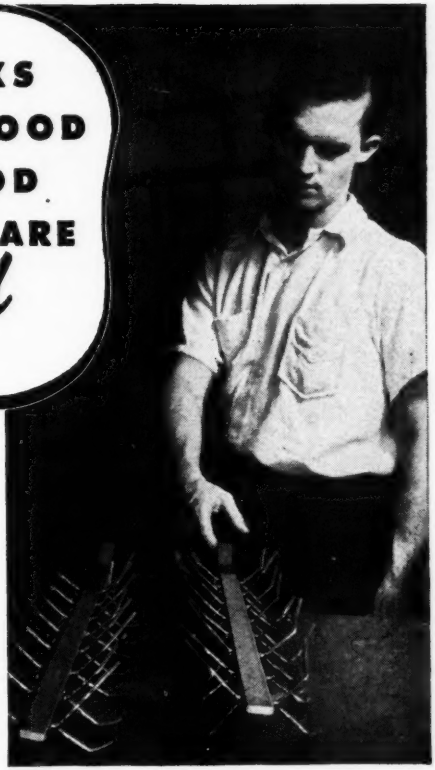
7000 PISTONS PER HOUR. 12 MACHINES.

Polishing and Buffing of Other Parts.

MAY WE SERVE YOU? ASK FOR BUL. No. 14.

THE PACKER MACHINE CO., Meriden, Conn.

PLATING RACKS ARE ONLY AS GOOD AS THE METHOD BY WHICH THEY ARE *Protected*



THE design and construction of a plating rack is important but, in the final analysis, the rack itself only serves as a skeleton over which protective coating materials can be applied. Without the right protective coating, the best rack ever made will not stand up effectively through your cleaning and plating cycles.

There is a *right* protective coating material for each of the various cycles in which racks may be used. One material alone will not provide all the characteristics to make it fully effective through all processes.

Miccro Products are available to meet your individual needs, not only for protective qualities necessary in specific processes but also for the most practical and desirable methods of application. In the five types of Miccro-Supreme Stop-Off Lacquers, or in Miccrolite or Miccroflex, you will find the materials exactly suited to your particular plating rack requirements.

Let us send you full information.

MICCRO-SUPREME STOP-OFF LACQUERS • MICCROLITE • MICCROFLEX

Developed and Manufactured By Experienced Platers

MICHIGAN CHROME & CHEMICAL CO.

6342 EAST JEFFERSON • DETROIT 7, MICHIGAN

HOWARD *can build the exact* MACHINE *you need*

One of the many types of cleaning machines HOWARD makes is this wash and rinse machine for cylinder blocks. Increase efficiency, cut cleaning or finishing costs with a HOWARD machine. Your parts will be processed in our Experimental Department . . . costs, methods, machinery analyzed . . . your problems solved — without charge or obligation. *Write for details.*

IMPORTANT NEW DATA
and applications of
HOWARD machinery.
SEND FOR YOUR FREE COPY

HOWARD *Engineering & Mfg. Co.*
1056 HULBERT CINCINNATI 14, OHIO

grilles on which bulky parts can be rested during the cleaning and rinsing processes.

United Industrial Portable Mixer

A belt-type portable industrial mixer, in which the motor hangs outside the tank and out of the path of destructive mixing fumes, is a recent development

United Industrial Portable Mixer

of United Electric Motor Co., 178 Centre St., New York, N. Y. Designed so that the balanced hanger carries the weight of the unit below the center of gravity, the mixer needs no tension on the clamp to hold it in place.

Either a.c. or d.c. low-cost motors may

NALCO DRITHERM
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Best For Infra-Red Ray Drying

Nalco Dritherm Lamps are the carbon filament type...proved for years in therapeutic and industrial practice as providing maximum emanation of infra-red ray within the desirable penetration band. Made only by—

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Adaptation of formulae to the individual requirements of busy war contractors.

Within specification limits there are many possibilities of improvement in speed, workability, and freedom from rejects.

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Cleveland, Ohio

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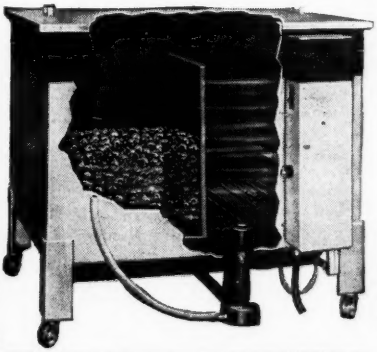

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Developed by Phillips, PHILLSOLV vapor degreasing solvent is tops for efficiency. It cuts vapor degreasing time by one third! Reduces vapor loss. Handles wider range of greases. Gives more thorough penetration of close, nested parts of ferrous and non-ferrous metals. Low toxicity—higher safety factor.

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A machine for every type of job. Portable—can be moved to the job. Require no gas, water or steam lines. Many other features. Write for catalog.

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be used, and precise mixing speeds are said to be obtained by simple pulley changes. Belts and pulleys in the mixer are of the V-type and are readily interchangeable for low or high speed mixing. The low speed and large propellers of the mixer increase mixing speed by allowing heavy liquids sufficient time to flow into the propellers. Pockets are prevented; air, which might be detrimental to the material, cannot be beaten in.

Bearings are combination radial thrust type; thus both the radial load of the shaft and the thrust encountered in pushing liquids up or down are taken care of. One complete piece, the heavy shaft, combined with the mixer's slow speed and rigid coupling, allows for longer shaft lengths for deep tanks. Propellers are of the large, slow-speed type and are held on the shaft only by set screws; hence cleaning, removal or replacement is easy. The mixer is furnished complete with a.c. 110-volt, 60-cycle motor; two balanced propellers; 30-in. steel shaft; 10-ft. cord and attachment plug.

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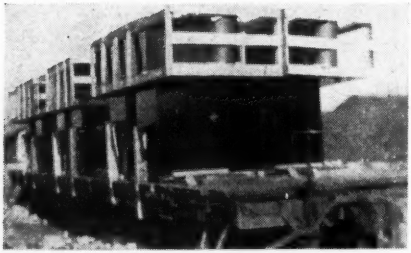
Better Paint
Adhesion
INDUSTRIAL CHEMICAL PRODUCTS CO.
DETROIT 7
Milwaukee **Fort Wayne**



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FREE! Engineering data on your tank problems. Write today.

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Academy 6560

Indium. The Indium Corporation of America, 60 E. 42nd St., New York 17, N. Y., has issued a brochure as an "interim" report on the progress being made with Indium. A concise summary of the development of Indium from its discovery in 1863 down to uses in 1943 is a feature of the booklet. One section explains how industry is making practical use of Indium. A copy of this attractive data booklet will be sent to any plant executive who addresses a request on his company letterhead.

Sweet's File for Product Designers. Of interest and valuable assistance to executives and engineers and designers concerned with product development is the Sweet's File for Product Designers, which has been issued recently. This publication is a file of 200 manufacturers' catalogs, and contains 1500 pages of specific product information on materials, finishes, parts, techniques and work equipment. The size of the file is 8½ x 11 inches.

Sweet's File for Product Designers is not only pertinent to today's production needs, but also has a wealth of information regarding forms, characteristics

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"MGC" ELECTROPLATING EQUIPMENT
Write for Interesting Details TODAY!
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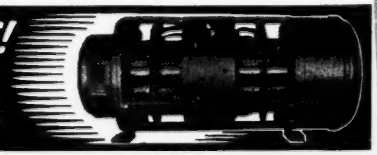

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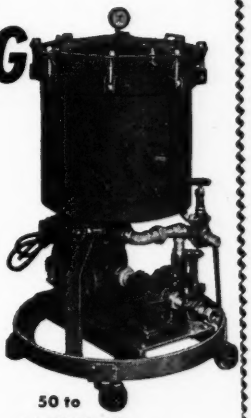
call for

HIGH SPEED FILTERING



Buy a filter with ample cake space, and you will find that you have purchased not only *"Ample Speed"* but *"Superior Quality"* as well. Hundreds of Sparkler users attest to the advantages of the Sparkler Horizontal Plate—they find it unexcelled for carbon treatment of solutions, very fast as a paper or pad filter, exceptionally easy to move about and clean.

Write for a Sparkler engineer—no obligation.

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50 to 10,000 G.P.H.

DOUBLE the Production of GRINDING OR POLISHING JACKS

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PORTER-CABLE Back-Stand Idler

By using a long abrasive belt instead of a grinding wheel, greater heat dissipation is obtained, cutting ability is increased, discolored work is prevented, abrasive is longer lasting. A hydraudic counterweight on idler keeps belt uniformly taut and true-faced. Quick speed-up and stopping . . . smooth running. The belt can be quickly changed to fit the job. No more dressing down of wheels. Saves in overall cost, too.

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PORTER-CABLE MACHINE CO.

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and performance of materials and equipment which will be incorporated in the products of the future.

Sweet's Catalog Service, 119 W. 40th St., New York, N. Y., offers this file free to qualified organizations having a continuous need for the information it contains and they invite inquiry from manufacturers or individuals who would be interested in obtaining it.

Backstand Idler. The Mattison No. 135 Abrasive-belt Backstand Idler, which converts regular grinding and polishing lathes to the use of factory-coated abrasive belts, is the subject of a circular issued by Mattison Machine Works, Rockford, Ill. The circular gives details of construction and contains a number of installation pictures, together with data and results obtained in actual production. Copy of the folder free upon request.

Flexite Pouring Buckets. A catalog section on its line of Flexite rubber pouring buckets, for the safe and economical handling of acids, corrosives and liquid high explosives, has been issued by The B. F. Goodrich Company, Akron, Ohio, and is available upon request. The publication also describes Flexite rubber dippers, hard rubber funnels, and Anode Acid rubber gloves.

"Win the War . . . But Plan for Peace" is the title of an interesting illustrated brochure prepared by The Fostoria Pressed Steel Corporation, Fostoria, Ohio, which illustrates how near infrared equipment has fit itself to diversified peace and wartime operations. A feature of the booklet is a case history of an installation at The White Motor Company which has been well planned for post-war operation, as well as for the present production of war products. Copy free upon request.

Opportunity Section

WANTED

by old established company — Technical Sales Service Men for servicing metal cleaning and wire drawing chemicals to war plants in the metal processing industries, chemical or technical background helpful. Good salary while training with drawing account and liberal commission plan when assigned a territory. Excellent postwar prospects. Address Box 124, PRODUCTS FINISHING, 431 Main St., Cincinnati 2, O.

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Leading manufacturer of raw materials, used by the paint, printing ink, textiles, rubber and lubricating industries, is looking for a man who is capable of taking charge of advertising and sales promotion work.

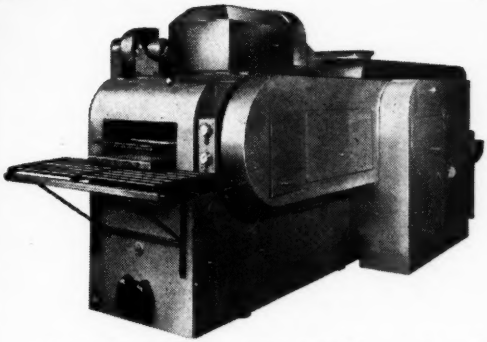
The right man should be able to take new products, determine the market. Survey and plan, then follow through a sales and advertising program.

The position is permanent, and the salary is open.

Reply by letter only to Box 127, PRODUCTS FINISHING, 431 Main St., Cincinnati 2, Ohio.

Replies will be held in strict confidence.

Our own employees know about this advertisement.



STURDY-BILT *Soaker-Hydro* METAL PARTS CLEANER

A production unit for the positive removal of dirt, chips, oils, greases, etc. Hot "SOAKING - PROCESS" combined with powerful washing action. Equipped with a built-in positive Drying Unit and Chamber. Parts are delivered properly dried and ready for the next operation.

Write for complete information

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Also manufacturers of "SIMPLEX" all-purpose metal parts cleaners.

Testing finishes simplified by *Taber* ABRASER

Comparative tests for adhesion, wearability and toughness of paint, lacquer, enamel, electroplate and similar finishes are accurately made from four-inch specimens. Results totalled on built-in counter in terms of wear cycles. *Write for Bulletin 2014.*

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The Finishing Touch

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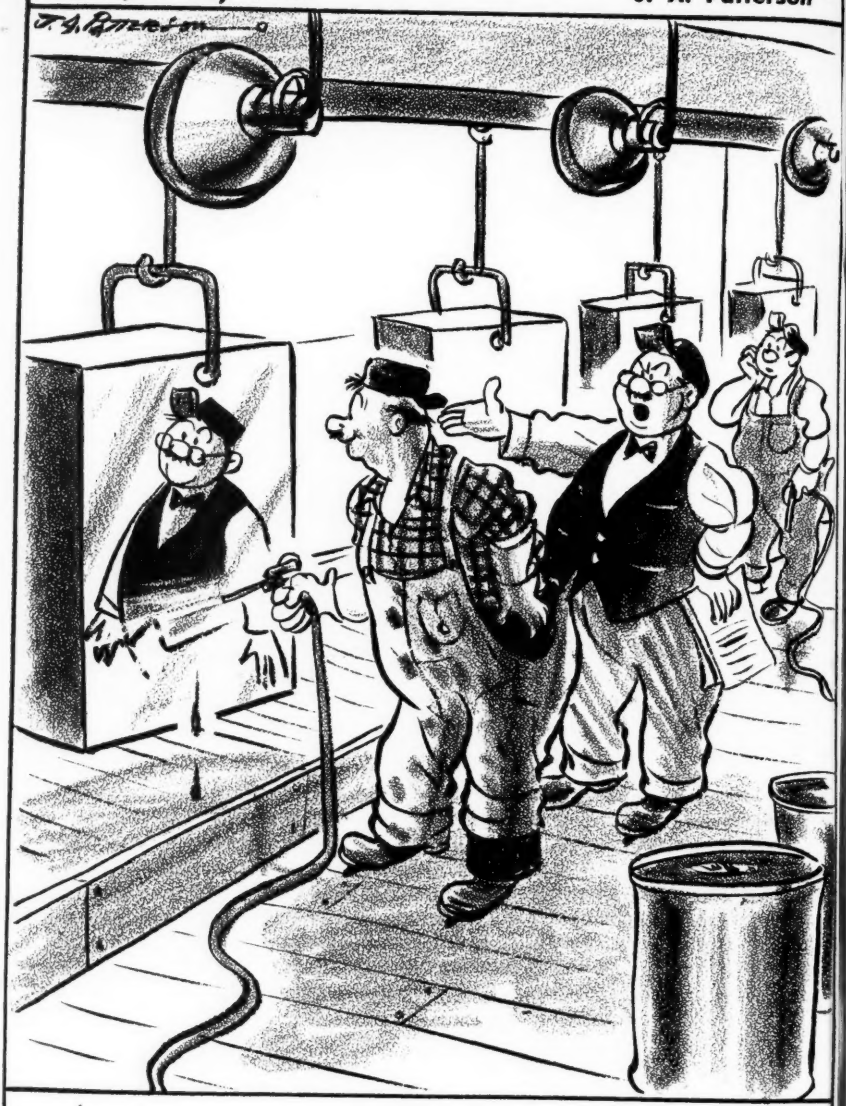

"All right, Rembrandt! Let's leave off the portrait work and get this job done."